THE
METAL INDUSTRY
WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW

Vol. 24 NEW YORK, JANUARY, 1926 No. 1

Casting Shop Practice

Operating the Casting Department of a Brass Rolling Mill

Written for The Metal Industry by WILLIAM J. PETTIS, Rolling Mill Editor

WILLIAM J. PETTIS

THE SCRAP ROOM

One of the vital units which enables the casting shop to maintain a high degree of accuracy, in the composition of the various alloys it produces, is the scrap-room, and its story is necessary in dealing with the casting shop.

The sources of the scrap are:

1. The metal loss which is closely identified with the actual casting operation, such as washings (metal recovered from the ash pit); sweepings after a crushing and washing process; skimmings, which are recovered by riddling buttons from bottoms of crucibles; gates and condemned castings that are cut up.

2. Scrap which is produced in the manufacturing process, accumulating in the various departments of the mill, such as sheet and strip metal, rods, wire, tubes, etc.

3. Scrap that comes from the outside, generally from the customer, who sends back the "skeletons", or scrap made in the process of fabricating their product. In addition to this some rolling mills buy, in the open market, such rolling mill scrap as will meet their requirements.

It is around this knowledge that each mill must plan and build the scrap room. The amount of scrap to be handled can be estimated with approximate accuracy. The number of different alloys, each one calling for floor space, make building a real problem, especially where the space alloted for the work will not admit of planning broadly, but is so constricted as to call for daily applied ingenuity. While this is a beautiful thing to watch, it never approaches the "fool-proof" situation. Genius gets sick, dies, or goes to ball games, and errors in the scrap room are generally costly.

The general plan of a scrap room calls for a receiving room for incoming scrap, where it can be classified and put in shape, by mechanical means, in the ways best adapted for handling in the casting shop. The scrap from the rolling mill consists of side trimmings and ends, from the slitting operation, and trimmings from the rolling process, "try-pieces," etc., and overhauling chips. The greater part of this scrap is light enough to cabbage, that is to compress under pressure into bricks; the size of the bricks to depend on the method used in melting. Where the electric furnace is used larger units can be handled, than when crucibles are in use. The overhauling chips are used either loose or annealed and cabbaged. There must be ample room for the machinery necessary to handle the scrap. The cabbaging machine, scrap winders, cutting up shears, magnetic separator, must be arranged to admit of free movement of the trucks used in moving the scrap to the casting shop; also from the machines to the storage bins. There must be storage bins not only for the different alloys, but for the different forms of scrap of the same alloy. From a casting of common high brass rolled into finished strips, for example, the scrap returned would be in the form of gates and heavy scrap, cabbages, overhauling chips and washings.

In making up a charge for the casting shop, first, a certain percent of new copper and zinc are weighed out. It is the best practice to allocate the scrap, a certain percentage of heavy scrap, cabbages and chips in one charge, rather than to use all heavy scrap one day and light scrap the next day. Also it is best to maintain a balance between the scrap received from the mill and the scrap used in the casting shop, and for this reason it is necessary that the scrap in its different forms be readily accessible for weighing out.

There are many "freak" alloys, that vary a little in the copper contents from the standard alloys or carry a little lead or tin, and this must be stored away, until a repeat order comes along; or built up, or cut down, as the case may be, into a standard alloy. While every effort is made to use as large a percentage of scrap in the alloy as is consistent with a high grade of brass, and thus keep the amount of scrap on hand at the lowest point possible, nevertheless the piling up of scrap occurs during those

periods when the casting shop is working short time, and the mill full time, plus shipments of scrap from the outside, and there must be storage room, to meet these conditions.

The method of weighing out the charges, the containers used and delivery to the casting shop, must be planned to meet local conditions. Where large tonnage is handled mechanical aids can be installed to facilitate this work, such as a moving table, which carries the containers past a battery of scales, each operator weighing out only one element of the alloy, thus reducing the chances of error. A splendid illustration of this method appears in a pamphlet entitled, "Seven Centuries of Brass," published by the Bridgeport Brass Company some years ago. It is obvious that such a method could not be used in a small plant and justify itself.

Washings present the worst problem in scrap handling. Some mills sell them to scrap dealers or foundries while others melt and cast into bars, classifying them by analysis. In some cases the washings are used "as is", a small amount being used in each new melt but this is not good practice.

THE CASTING SHOP

The metal delivered to the casting shop is carefully apportioned to make a given alloy, with each pan so marked, and the casters' only care is to use their skill in melting and producing good castings. They must also see that their firemen perform their work with a minimum of loss of metal, such as letting the scrap fall into the fire instead of the pot, spilling the melted metal when pulling the pot from the fire, and they must prevent excess zinc loss during and after "speltering". The loss through metal going into the ash pit will run one per cent plus, depending on the skill of the firemen. This is recoverable and is classed as washings. The zinc loss will run six per cent net, including good, bad and indifferent firemen. This is not recoverable. Further shrinkages of the melt result from skimming the pot, spills from pouring the metal into the moulds (or rather not pouring into them), and skulls left in the strainers. These are all easily recovered. In electric furnace melting, a method that is now doing a large part of the work formerly done by crucibles, the zinc loss is less and there are no washings. The other losses run about the same, but the working conditions are improved. The treatment and handling of the moulds is as important as the melt, for a perfect melt, poured into improperly treated moulds, means a bad bar.

The moulds are made of cast iron, and for flat metal, that is strips and sheet brass, they are in two pieces, a back and a front. The usual range of sizes of the brass castings in these moulds is from five inches up to fourteen, in width, and about one and one-eighth inches thick. The length is from three to nine feet, depending upon the width, and these are generally cast in one hundred pound units. The weight of the mould itself is about three hundred pounds. There are two types, one the banded mould, where the two parts are held together by iron bands, slightly larger on the inside diameter than the outside diameter of the complete mould, and iron wedges driven between the band and the mould to hold the parts together firmly. This type of mould has been in use several hundred years, and is still good. The second type is the "hinged" mould, the front being hinged on one side of the back, and operating like a door. When closed the parts are drawn together by hooks hung on the outer edge of the back, drawn over a rod running across the front of the mould, extending beyond the edge, in line with the hooks. This type of flat mould has been introduced in the last fifteen years or so and is also in very common use.

For rod billets and tube castings a round or "cannon" mould is used, and the name aptly describes it, for when swung on trunions in the casting pit it resembles an inverted cannon. The billets and "rods" are solid castings, the diameters running from one and one-half inches to eight inches. The billets are used in making rods, by the extrusion process, tubes by the piercing process, and call for special care in the castings, as the alloy must be exact, and the casting homogeneous, properly "shrinking". A large diameter billet casting calls for no little skill. Such alloys as are not adapted for the extrusion process, in making rods, are cast in the smaller diameters, and reduced by rolling.

A PIT FIRE CASTING SHOP

The same thing applies to such seamless tube alloys, as make the piercing process impracticable. These alloys are cast into "shells" and reduced by a cold drawing process. The cannon moulds are used with a core of sand inserted in the center of the mould around which the shell is cast.

CORES

The making of the core requires a number of operations, special equipment and expert workmen. After the tube is cast the process of removing the core from the casting alone puts a heavy tax on the operation. The foundation of the core is an iron pipe about five feet long, and drilled along its length with four rows of seven-sixteenth inch holes two and one-half inches apart. Over this pipe is wound a layer of marsh hay that has been put through a steaming process to make it flexible. Over this is plastered a layer of a special sand that has been moistened to the consistency of mud. The core is then placed in a drying oven and when thoroughly dry is taken back to the core bench and a second finishing coat of fine "mud" is applied and the drying process repeated. They are then painted with a preparation of whiting or black lead, given a last drying and are ready for use. One core bench will finish about one hundred cores a day. The greatest care has to be exercised in handling the cores at all times and in stacking in the drying oven. The oil used in dressing the moulds is generally a first grade lard oil and seems to give the best results. Though most of the animal, vegetable and mineral oils have been tried, both alone and in combination, they have not displaced lard oil, and as five quarts will dress moulds for about ten thousand pounds of castings the comparatively high cost of the lard oil is not a factor.

The position in which the moulds are set, the condition of the surface of the moulds, the speed of pouring the molten metal (this is governed by the number and size of the holes or outlets in the strainer), proper pouring heat of the metal and the necessity of modifying these conditions to meet the demand that different widths of moulds impose, make it a complex operation, and the man who has completely mastered it is indeed a master caster.

Brass

An Old Alloy That Every Now and Then Is Being Rediscovered as a Great Servant of Mankind. From Research Narrative No. 109

By W. G. SCHNEIDER

Research Department, Copper and Brass Research Association

Crucible furnaces were used for brass from the earliest times. Calamine (a zinc ore) was the primitive source of zinc. This practice continued to the eighteenth century, when metallic zinc was employed. No further great changes occurred until about ten years ago, when the electric furnace largely replaced the crucible furnace.

Brass was produced in the American Colonies first at the iron foundry of John Winthrop, Jr., Lynn, Massachusetts, in 1644. Cast brass was produced at Philadelphia also previous to the Revolution. The brass business developed from the manufacture of buttons. At Waterbury, Connecticut, in 1750, John Allen established a brass factory and in 1802 scrap copper and zinc from England were fused together and cast into ingots, subsequently rolled into brass sheets and used for buttons. From this humble start the brass industry of the United States, transplanted almost bodily from England, with the exception of brass spinning, has grown to be the greatest in the world. Connecticut now produces 60% of the world's brass.

As production of sheets, rods, wire and tubes increased, the use of brass was extended to other than button purposes. The attractive finish that may be given it, its strength, easy workability and rust resistance so encouraged possible users that consumption of copper by brass mills grew from less than 50 tons in 1820 to over 300,000 tons a century later.

Short brass pipes were used by the Romans as water-measuring devices. The copper pipes of ancient Egypt, however, are the forerunners of modern plumbing pipes. A piece of copper pipe in excellent condition, in the National Museum at Berlin, believed by Egyptologists to be over 5400 years old, unearthed several years ago at Ghizeh, near the tomb of King Sahoure, undoubtedly was used to convey water to his palace and that of his successors. Between copper pipe in Egypt and brass pipe of today are many devious steps,—open troughs of stone and of wood, lead pipe, wooden pipe, iron pipe, steel pipe, tin pipe, concrete pipe. In 1838 the process of producing seamless brass tubing was invented in England and in 1850 was introduced in this country; it is giving fresh impetus to the brass industry.

Brass spinning invented by Hiram W. Hayden, of Waterbury, in 1851, was the first real forward step contributed by America. It quickly replaced the tedious method of producing cupped articles such as vases, pails, pots, other containers and many ornamental objects, by which a disc of metal was hand-hammered and otherwise worked until the desired shape was obtained. In spinning, the disc is mounted in a chuck, which is rotated at the proper speed. By holding suitable tools against the revolving metal it is thinned out over wooden or metal forms to the intended shape.

Hayden's first spinning was done at Wolcottville, now Torrington, Connecticut. According to two daughters who survived him, he invented as a pastime. Among his inventions were a process for color photography and a rifle, displaying wide diversity. He invented many things, but he kept no records. Just what experience or observation or line of thought suggested the method called spinning cannot now be ascertained. One of the largest uses for brass in his day was the manufacture of kettles and pails, originally cast and later hand-hammered from discs. The success of the handhammered kettle was short, because the first kettles so produced were manufactured from the wrong alloy and were unsatisfactory.

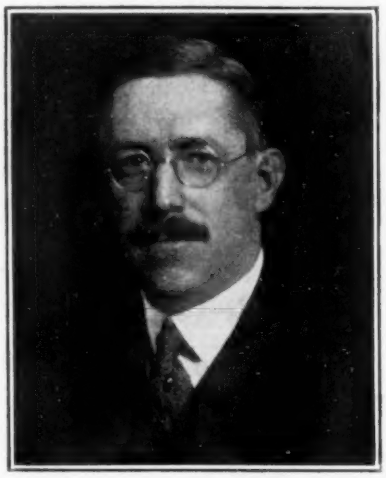
Brass pails made by methods in use in 1850 had thin bottoms. To overcome this fault Hayden devised the spinning process. He marked all of his pails as soon as he began manufacturing them by this method. Miss Hayden still has in her home one of the first pails produced by her father in 1851, bearing the date and his name. Hayden also used his process at one time in Waterbury for manufacturing lamps. It was in December 1851 that Hayden brought out the spinning process. In 1852 he sold it to the Waterbury Brass Company. Use of the process has grown so that it may be said to be universal today.

The world is again discovering copper and brass for a great variety of uses and may be said to be entering, on a grander scale, a second Bronze Age, using copper and its alloys much more extensively.

Technical Control in the Foundry

Why a Technical Department Should Control the Foundry

Written for The Metal Industry by N. K. B. PATCH, Secretary, Lumen Bearing Company, Buffalo, N. Y.



N. K. B. PATCH

The modern foundry is today as dependent upon technical control as any of the industries. A well-organized foundry, therefore, includes the necessary technical help with its corresponding apparatus and equipment. This is the "laboratory" of the industry. Here much is accomplished that is vital to the carrying on of the business in the highly competitive field of trade. Here the "practical" foundryman turns for guidance and help in correcting the mistakes that arise from erroneous practices, sometimes of long standing, through the old-fashioned "rule of thumb" methods handed down through the years.

Many relatively successful foundrymen still boast that they need no laboratory and point to their records of the past as proof of this statement. They do not realize that all too frequently they have lost orders because a competitor, better equipped by laboratory control, has made a better product and thus taken the business, possibly at a cheaper price, or as is frequently the case, even at a higher price. Thus the volume of business is shrinking year by year, but conditions still enable him to hold enough business to show a profit.

Let us see what might have been the case had he pursued the more modern course and added a laboratory and the necessary technical staff to his organization. At first the "overhead expense" increases and he is then tempted to prophesy the destruction of his profits. This condition changes almost immediately, however, since this department enables him to make many material savings. In buying his supplies, he can inform himself of the actual relative values of the different materials available. His technical men uncover wasteful methods of production and useless practices that have crept in through long use. All too frequently these have grown up in a foundry operating without technical control; guess-work has incorporated in the many steps of production, practices which are either unnecessary, or which can be materially cheapened or modified without impairing the quality of the product. In fact, their elimination or modification may often improve the resulting product.

In referring to a laboratory in this article, this term is used to embrace much more than a department where chemical analysis may be made. Such a department as we have in mind should include a small equipment for chemical and physical testing, but this may be at first of the most modest nature. As the department grows in usefullness, the natural development will obviously suggest additions and modifications that are consistent with economical growth. Such a department, properly manned, cannot fail to effect an improvement in the metal cast in the molds. How else can the necessary knowledge relative to the use of proper blends of metals be gained? Where else can the scientific application of the melting medium be secured? Who can better dictate the desirable heat treatments, the temperatures incident thereto, and the advisability of such processes?

The foundry having a technical department is also able to maintain uniformity in product and supplies, which is impossible otherwise. Take the control of sand for the production of the molds and cores. It is rapidly becoming evident that the waste in discarded sand can be largely avoided; and not only that, but the fact is increasingly evident that the rejection of castings can be materially reduced by careful control of the uniformity of bond and moisture in the sand heaps, to say nothing of the faulty castings saved through scientific mixture of core sands and binders. Also this department may make a material saving for the foundry by enabling the use of a local sand rather than a sand shipped from a distant point, necessitating a high freight expense and consequently a large outlay for one of the major supplies used in this industry. This department may even become an asset to the commercial side of the business by the development, through intelligent research, of new alloys or other new products, which may be added to the lines sold, with consequent financial gains.

It is the obvious function of such department to digest valuable literature dealing with the many phases of this business, and to apply this information to the foundry by which it is employed. There is much of importance and commercial value being published in these days of the modern technical societies, such as The American Foundrymen's Association, American Society for Steel Treaters, American Society for Testing Materials and American Engineering Standards Committee; not to mention the European Societies and also the Japanese publications. The trade and technical journals do their best to digest the work of these societies and broadcast it, and are vital factors in the development of the industry. But, without technical men to understand and apply this enormous fund of information, that foundry is handicapped. Much of the information so published is the direct result of the application of such a department to some of the foundries, and those who have not yet added such a department to their organization have been benefitted by the presence of technical control to at least a part of the industry. If, therefore, those foundries get an indirect benefit from the technical control of their fellow foundries, how much more would they benefit by the application of a technical department and laboratory to their own organization, which would devote itself to their own immediate problems and give them the benefits to be derived from a thorough understanding of the valuable literature?

In outlining the application of a technical department to a foundry, only the high spots have here been touched upon. Obviously there are many minor points wherein such a department would effect a material help toward improvements in product and increases in earnings. These minor items are of so large number, however, that in the aggregate they become of major importance, and must not be neglected in consideration of the subject.

Melting and Casting Metals

A Variety of Problems and Their Solutions

Written for The Metal Industry by WILLIAM J. REARDON, Foundry Editor

ALUMINUM ALLOY FOR STEAM PRESSURE

Q.—Please furnish us with an aluminum base alloy for steam pressure castings. Metal thickness ½ in., castings 4 ft. x 6 ft. x 4 in. high, used as steam chests. Alloy must withstand 20 pounds pressure.

A.—We would suggest a mixture of 87½ aluminum; 12 copper and ½ magnesium. Or 85½ aluminum; 14 copper and ½ magnesium. Make a hardener of 50 copper and 50 aluminum. Use electrolytic copper and virgin aluminum; pour in ingots and use as follows: 71½ aluminum; 24 or 28 hardener; ½ magnesium.

This alloy has been found to be very satisfactory for aluminum castings to stand pressure.

WILLIAM J. REARDON

METAL FOR WELDER JAWS

Q.—We would like to know if you could advise us of the best mixture used for making jaws, to be used on an electric welder, which are used for welding tires used on the wheels of threshing machines.

To date we have found Tobin Bronze to resist the action better than anything else. The tires are butt welded but the heat seems to destroy the brass bearings or jaws.

A.—If you do not require conductivity we would suggest a mixture of 90 copper and 10 aluminum. Make a hardener of 50 copper and 50 aluminum. Pour into ingots and used as follows: melt 80 pounds of copper and add 20 lbs. of hardener. Stir well before pouring. In molding the jaws use a long run for the metal in the gate before entering the mold. The casting must be free from dross and shrinks.

If this mixture will not answer your purpose, try pure copper. This material is generally used for welding jaws. Use 3 to 6 ounces of silicon copper as a deoxidizer per 100 lbs., and pour a sample sprue before pouring the casting. This can be done by inserting the sprue cutter in the sand to a depth of 3 in. If the metal comes up it has not been properly melted and deoxidized and should not be poured.

However, we are of the opinion the Aluminum Bronze will meet your requirements.

CLEANING BRASS CASTINGS

Q.—Can you suggest a reliable method in cleaning rough brass valves to remove the oil and smudge that occurs through handling the valves during machining and assembling, so that they will have a bright clean color for shipping.

The objection to pickling is that the valves tarnish later. The purpose is to keep them bright and clean for shelf goods. The valves are made of 85-5-5.

A.—The method generally used to clean valves that have become dark and smudged in handling through the different finishing operations, is to wash them in benzine using a long handle brush to brush them. This will remove the oil and grease and bring out the original color of the metal, which in valve work, is so much desired, as it shows the goods have been made from high grade metal.

PRESSURE METAL

Q.—Will you kindly let us know what red brass composition alloy is best suited for casting water jackets, which must stand a pressure of 150 lbs. We have furnished our customers with the regular 85-5-5-5 ingot composition, but this does not seem to be satisfactory. We believe an alloy with perhaps higher tin and lower lead or zinc content would be more satisfactory.

A.—The mixture we would suggest for this work consists of 80 copper, 10 zinc, 7 lead, and 3 tin. This mixture is used for air pressure work and is quite satisfactory and we believe will answer your requirements. You understand that this mixture should be made of at least 50 per cent new material and be free from antimony and aluminum. We contend the high lead content will give a closer grain metal with less shrinkage. Do not pour over 1,900° F.

PAINTING ALUMINUM MELTING POT

Q.—We are confronted with a problem in aluminum melting and would like to ask your advice as to the best mixture you know of for painting the inside of a cast iron melting pot in order to prolong the life of the pot. Heat is applied to the pot by a low pressure gas flame.

A.—The best method to prolong the life of a cast iron pot for melting aluminum is to pour out all the metal every night, when through melting and clean the pot. The pot should be made of a semi-steel mixture, that is a low phosphor iron where 10 to 20 per cent steel is added to the mixture.

There have been washes used such as kaolin, a porcelain clay and bone ash mixed. It will help considerably, to use a mixture of 70 kaolin and 30 bone ash and paint on the pot.

However, the most efficient method is as stated above is to clean out the pot every night.

COARSE GRAINED CASTINGS

Q.—We are mailing you under separate cover two specimens for your perusal. You will please note that the fracture shows a very coarse grain, the crystals stand out very prominently and have a dark color.

We have been running these parts for the past four years, with very good results, using foreign heavy red scrap, and copper with 85 and 3 fives ingot. The past two weeks our castings have been leaking and cracking the cracks showing up after machining. We have run analyses on pieces taken from scrap copper and red scrap, and found same containing iron. Also analyzed our fuel oil which shows sulphur.

We are melting in crucibles using tilting furnaces. The metal is kept well covered with charcoal and fluxed with 15 per cent phosphor copper.

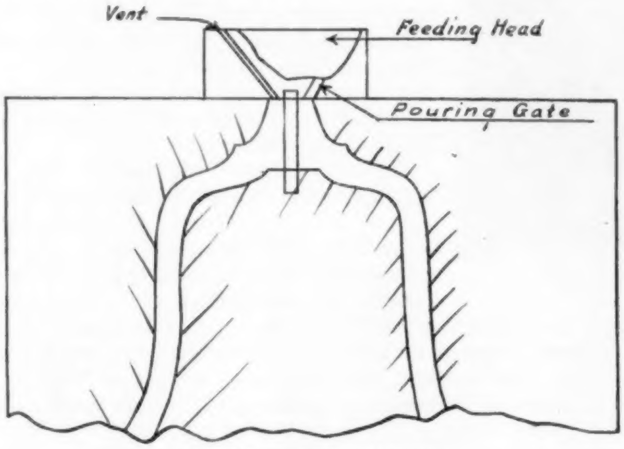
Kindly advise what percentage of sulphur is detrimental,

and any other information you can give us after your inspection of the samples.

A.—On examination of samples casting we can see very little wrong with the metal other than an open grain. There is no trace of oxide. The grain has the appearance of low lead content and we would suggest that you add 3 per cent more lead to the mixture to close the grain. If this does not make grain close enough add 1 per cent more; or with a little experimenting you will find the right amount.

You do not state how much sulphur your fuel oil contains. Fuel oil containing 0.5 or under sulphur, is considered a good grade of fuel oil.

If it contains over 0.5 sulphur, the absorption of sulphur by the metal can be prevented to a considerable extent by using a small amount of soda ash as a flux to the metal and cover with charcoal.



GATING A BELL CASTING

As stated above we think you can help yourself considerably by adding lead to close the grain and reduce shrinkage and if your fuel oil contains over 0.5 sulphur use the flux given.

FUSIBLE ALLOY FOR BRINE

Q.—Can you advise us where we can get an alloy that will not be attacked by brine and that will melt at a temperature of 200° or thereabouts?

A.—This is a rather difficult alloy to obtain. However, suggest you try a mixture of:

Bismuth	52½
Tin	15½
Lead	32

This alloy will fuse about 200° F. and should answer your purpose. You can get almost any of the smelting companies to make it up for you or you can make it up yourself.

BELL CASTING

Q.—Kindly advise the proper way to gate a bell cast of brass. Also furnish several good mixtures for same, exclusive of silver?

A.—The proper way to gate a bell casting of any size, is as per sketch. All bells weighing 2,000 pounds or more are poured in a pit. The whole mold is lifted by a crane and lowered into a pit, after runner boxes are arranged for pouring. The mixtures for bells run from 13% to 20% tin, balance copper.

The composition used for bells for chimes is about 80 copper, 20 tin. Besides the composition the other point to watch, to assure the rich tone of the bell, is its shape and contour.

Sherardizing Copper Wire

Written for The Metal Industry by JESSE L. JONES, Metallurgical Editor

Q. I am interested in sherardizing a copper wire in coils from No. 30 to 16 B and S gauge. The wire, after sherardizing, must have a golden yellow, not a gray color. It must be sufficiently ductile to be drawn to No. 40 B and S and still retain its color and polish. The zinc content would be 4 to 6 per cent.

I have reviewed the best works on sherardizing, but have found no information of any assistance to me.

Can you refer me to any one or any literature regarding process for copper wire.

A. I am inclined to think that it is not possible to sherardize a copper wire so that it would have a brass color, the colored surface containing approximately 4 to 6 per cent of zinc and being of a uniform golden yellow color. It would no doubt be possible to sherardize copper wire by passing it through a retort containing zinc dust at a suitable rate of speed. I would expect this process to give a gray color, which migh be changed to a brass color by heating in a muffle until the zinc was alloyed with the copper, but the manipulations necessary to secure a uniform alloying of this coating so as to produce a standard color would seem to be almost a mechanical impossibility.

I would be inclined to think that it would be more feasible to take a piece of brass tubing of the color desired, insert a tightly fitting rod of copper in it and roll and draw the composite piece to the gage of wire desired.

Tantalum to Replace Platinum

Prof. J. C. Withrow, head of the department of chemical engineering in Ohio State University, Columbus, Ohio, has made the following statement through the American Chemical Society:

The chemist looks upon platinum as one of his most resistant metals to corrosion. Its use in jewelry, however, is damaging chemical engineering and research.

The new metal, tantalum, can be used as an engineering material and so far has developed to be almost as valuable in resistance, the experiments at Ohio State University show, as platinum-iridium, one of the most resistant alloys known. For instance, platinum is found to lose 1 gram per 100 sq. cm. in electrolytic corrosion in 60 hr., while tantalum requires 100,000 hr. for the same loss and platinum-iridium 125,000 hr. The half life of a No. 27 Birmingham wire gage of cathode thickness of platinum was 114 days, whereas tantalum would only be one-half gone at the end of 525 yr. and platinum-iridium at the end of 656 yr. In spite of this great saving, tantalum is about one-twentieth as expensive in first cost as platinum. Platinum-iridium costs, today, $4,330 per kg.; platinum, $4,000 per kg., and tantalum sheet, $250 per kg.

Tensile Properties of Soldered Joints Under Prolonged Stress

A Report of Tests Made at the Bureau of Standards with Tin, 50-50 Solder, 60-40 Solder on Various Materials*

By JOHN R. FREEMAN, JR., and G. WILLARD QUICK, Physicist and Associate Physicist, Respectively, in the Division of Metallurgy, National Bureau of Standards, Washington, D. C.

The Bureau of Standards receives numerous inquiries regarding the strength of soldered joints with particular reference to their permanence under a definite load applied over a long period of time.

It has been commonly, although not universally, believed that any soldered joint will creep under any load no matter how small, the amount of creep depending, of course, upon the load. A search of the literature revealed reports of numerous tests of the tensile strength[1] of solders and soldered joints but in all cases the tests were made with the load increasing during test at a uniform rate until fracture occurred. No data were found regarding the permanence of a soldered joint under a prolonged application of a definite stress. Therefore the few tests reported here were made.

TENSILE PROPERTIES OF PURE METAL AND SOLDER

As a preliminary to tests of soldered joints under prolonged application of stress, it was thought desirable to make first a series of tests on the pure metals, lead and tin, and a 50-50 solder. Wires 6 inches long and approximately 0.10 inch diameter were made from commercially pure lead, Banca tin and a 50-50 mixture of the two metals. Loads producing the unit stresses shown in Table 1 were suspended from these wires and the elongation with time measured over a 2-inch gauge length. The tests were continued for a period of 28 days on specimens which did not break under the applied loads.

The fact that the lead wire sustained without appreciable elongation a unit stress of 415 lbs/sq.in. and failed under a unit stress of 690 lbs/sq.in. indicates that lead will support for an unlimited period a unit stress greater than 415 lbs/sq.in. but less than 690 lbs/sq.in.

*Published by Permission of the Director of the National Bureau of Standards of the U. S. Department of Commerce.

[1] Crow, T. B. "Some Properties of Soft Soldered Joints," Journal Soc. Chem. Ind., March 21, 1924; "Some Scientific Aspects of the Process of Soft Soldering," Brass World XXI, p. 39, Feb., 1925.
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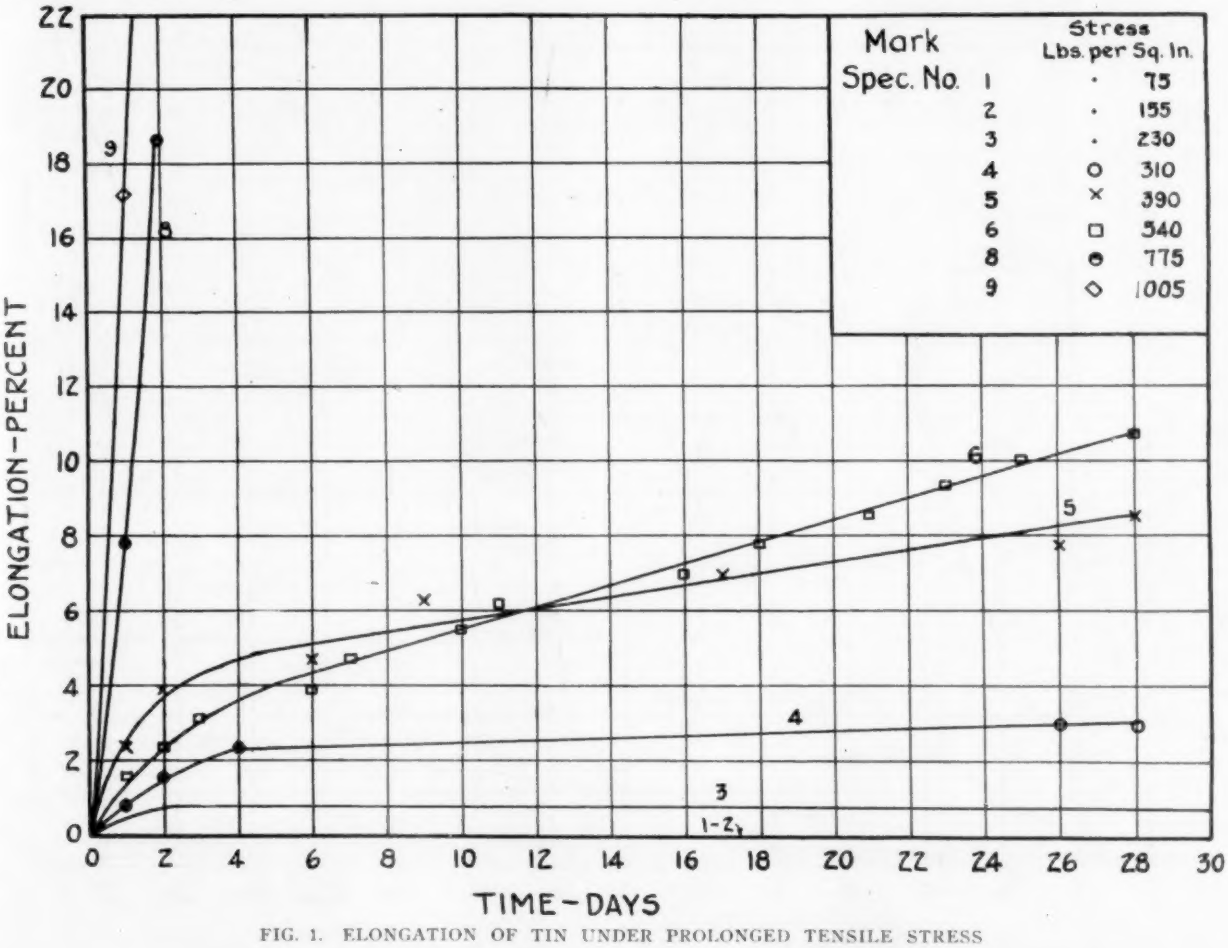


FIG. 1. ELONGATION OF TIN UNDER PROLONGED TENSILE STRESS

The results of the tests on the pure tin wire and 50-50 solder are given in Figures 1 and 2, in which the time in days is plotted as abscissae and the percent elongation as ordinates. In all cases in which elongation of the wire occurred during the 28 days of test the specimen would undoubtedly have failed had the test been continued with the possible exception of tin wire No. 3 and solder wire No. 5 which were under unit stress of 230 and 70 lbs/sq.in. respectively. In these two instances the small elongation noted and the fact that it occurred shortly after the beginning of the test and then stopped, indicated that such elongation as might have been continuing, was very slight and specimens would have had a very long if not unlimited life. Tin wire specimen No. 2 under a unit stress of 155 lbs/sq.in. showed no elongation during the 28 days test period. It may therefore be concluded that pure tin would probably sustain for an unlimited time a constantly applied stress greater than 155 lbs/sq.in. but less than 230 lbs/sq.in. or probably about 200 lbs/sq.in. The solder wire evidently will not sustain so great a load as the pure tin. In fact the data indicate that 50-50 solder would show appreciable elongation when subjected to stresses greater than approximately 50 lbs/sq.in.

The curves obtainer are typical of so-called "flow curves" obtained in similar tests of a mild steel[2] at elevated temperatures. Under the lower stresses at which slight elongation with time or flow occurs, the flow is rapid at first and then becomes less, the curve approaching a horizontal to the time axis or zero rate of flow, while with large loads the rate of flow increases with time until fracture occurs. This resemblance of the flow curves of mild steel at elevated temperatures probably has some relation to the fact that at the respective temperatures of test the mild steel, tin and solder are at or near their respective temperatures of recrystallization.

TABLE 1—TENSILE PROPERTIES OF LEAD, TIN, AND 50-50 SOLDER

Spec. No.	Unit Stress lbs. per sq. in.	Duration of Test Days	Results
		Lead Wire	
1	140	28	No elongation.
2	275	28	No elongation.
3	415	28	No elongation.
4	690	27	Failed—final elongation 20.5 per cent.
		Tin Wire	
1	75	28	No elongation.
2	155	28	No elongation.
3	230	28	0.78 per cent elongation on 3rd day. No further elongation.
4	310	28	Did not fail—3 per cent final elongation.
5	390	28	Did not fail, 8½ per cent final elongation.
6	540	28	Did not fail, 10½ per cent final elongation.
8	775	3	Failed during 4th day.
9	1,005	3	Failed during 4th day.
		50-50 Solder Wire	
5	70	28	0.78 per cent elongation on 3rd day. No further elongation.
6	135	28	3.1 per cent final elongation.
7	205	28	20.0 per cent final elongation.
8	270	15	Failed during 16th day.
1	340	7	Failed during 8th day.
2	475	2	Failed during 3rd day.
3	680	1	Failed during 2nd day.
4	1,020	1	Failed during 2nd day.

PREPARATION OF SOLDERED JOINTS

A series of soldered lap joints were then prepared in

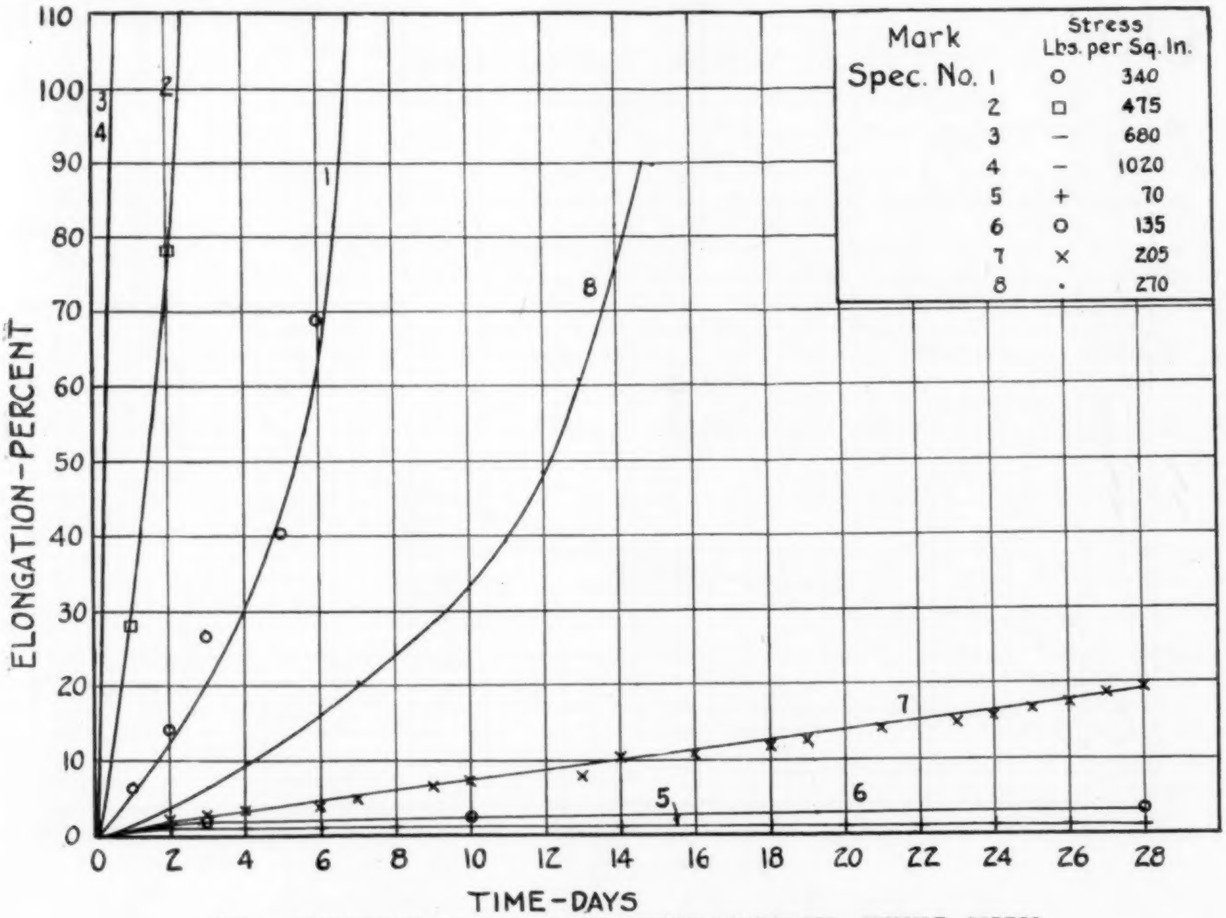


FIG. 2 ELONGATION OF 50-50 SOLDER UNDER PROLONGED TENSILE STRESS

which the "creep" under prolonged application of stress was studied. They were made of galvanized iron and sheet brass "soldered" with pure tin, a 50-50, and a 60-40 lead-tin solder respectively. The dimensions of the test specimen are shown in Fig. 3. The galvanized iron and the brass were 0.034 inch and 0.025 inch thick respectively.

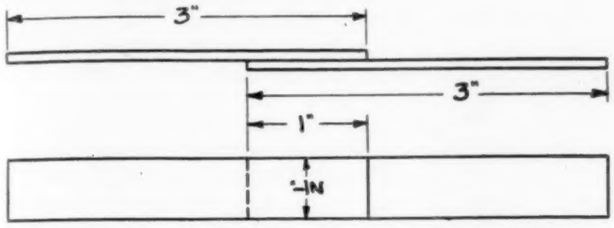


FIG. 3 TEST SPECIMEN FOR SOLDERED JOINTS

All the joints were soldered under as nearly identical conditions as possible. The lap areas were first cleaned with hydrochloric acid. They were then carefully "tinned" with the solder to be used. Care was taken to put on as smooth and uniform a thickness of the solder as possible. The two portions were then placed with the "tinned" surfaces in contact in the apparatus shown in Fig. 4, which was built from designs kindly given to the authors by W. A. Cowan, of the National Lead Company. The

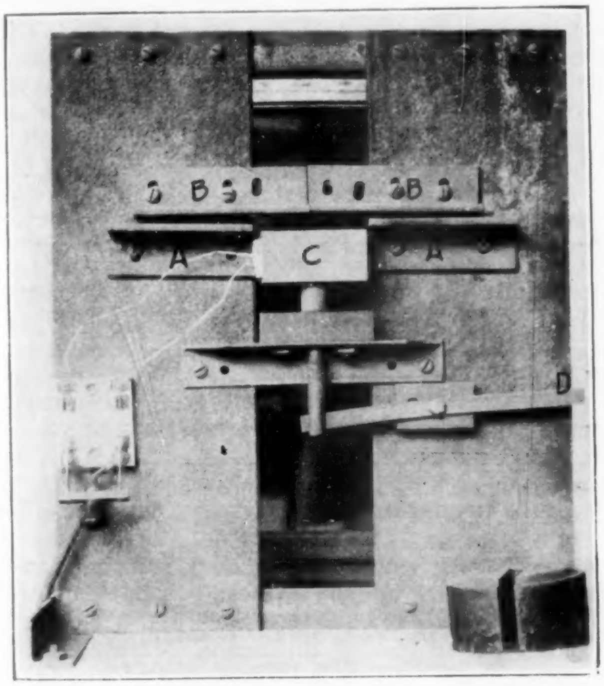


FIG. 4 APPARATUS FOR SOLDERING TEST SPECIMENS

two portions of the specimen to be soldered were placed on the angle irons marked A. These were then then moved up so that the specimen was held firmly against the upper angles B. The thin walled metal box C, contained a heating element which could be held at a known temperature. This was pressed up against the lapped areas to be soldered by means of a known load applied to the end of lever arm D. In soldering a joint the desired temperature above the melting point of the solder was maintained for the same length of time in preparing each specimen. The heating current was then cut off and the specimen allowed to cool well below the melting point before the pressure was released.

TESTS OF SOLDERED JOINTS

The soldered specimens were supported at one end and loads of 50, 100 and 200 lbs, respectively hung from the other end, giving the approximate unit shearing stresses shown in Table 2. Strain gauge marks 2" apart covering the lapped area were punched on the specimen previous to loading and extension with time under load measured with a Berry strain gauge, readings being made daily during the first week of test. Measurable "creep" previous to failure was not observed. Curves showing rate of creep were therefore not obtained.

The results of the tests on soldered joints are given in Table 2. In discussing these data, it should be noted that except in a few instances only one specimen was tested for each condition. The data therefore should be considered indicative rather than conclusive. In those cases where duplicate tests were run the first test was thought to have failed prematurely due to imperfect soldering. The truth of this assumption was proved by the fact that the duplicate specimen had a much longer life in every case except for the tests of galvanized iron joints at 400 lbs/sq.in. load. In this instance the agreement between the duplicate tests is very close and probably represents the strength of the joint.

Certain general conclusions may be drawn. It is evident that pure tin is a stronger "solder" than either a 60-40 or 50-50 lead tin solder, none of the speciments soldered with tin having failed even under the highest load. Lap joints of galvanized iron and brass strip soldered with pure tin will apparently sustain a load greater than that which produces a unit shearing stress in the lap area of 400 lbs./sq. in. Similar joints made with 50-50 or 60-40 lead tin solder fail very quickly under this stress but will apparently sustain a unit shearing stress of 200 lbs/sq.in.

Both of the lap joints of galvanized iron soldered with 60-40 solder and tested under a unit stress of 400 lbs/sq. in. failed within 8 days, and the respective tests using 50-50 solder failed in less than 5 days. On the other hand the comparative tests of brass joined with these two solders had a relatively much longer life; over 80 days and 15 days respectively. It may be concluded that the solders and probably the pure tin make a stronger joint with brass than with galvanized iron.

TABLE 2—LIFE OF SOLDERED JOINTS

Type of Joint	Shearing Stress lbs./in.[2]	Duration of Test in Days.	Results.
Galvanized iron soldered with tin	100	509	Did not fail.
	200	456	Did not fail.
	400	456	Did not fail.
Galvanized iron soldered with 60-40 lead-tin solder.	100	509	Did not fail.
	200	7	Failed in 7 days.
		439	Did not fail.
	400	8	Failed in 8 days.
		8	Failed in 8 days.
Galvanized iron soldered with 50-50 solder........	100	15	Failed in 15 days.
		414	Did not fail.
	200	456	Did not fail.
	400	0	Failed on 1st day.
		5	Failed on 5th day.
Brass soldered with tin.....	100	509	Did not fail.
	200	456	Did not fail.
	400	456	Did not fail.
Brass soldered with 60-40 lead-tin solder	100	509	Did not fail.
	200	456	Did not fail.
	400	80	Failed in 80 days.
		86	Failed in 86 days.
Brass soldered with 50-50 solder	100	509	Did not fail.
	200	456	Did not fail.
	400	15	Failed in 15 days.

[2] "Flow in a Low Carbon Steel at Various Temperatures," H. J. French and W. A. Tucker, Bureau of Standards, Tech. 296 1925.

A comparison of the data on soldered joints and tests of the metal or solder in wire form shows that the load sustained by the metal or alloy alone is marketdly less than when used as a solder and that the metal or alloy in wire form has considerable flow under constant load, while in the soldered joint failure occurs very shortly after flow or creep of the joint begins. In the wire, elongation takes place by contraction in area. In the soldered joints such contraction can not occur. The most desirable joint, therefore, has minimum thickness of solder required to coat the surfaces and avoid air bubbles. The strength values of the wire and soldered joint are not directly comparable for in a test of wire the material is under pure tensional stresses, whereas in the joint it is under practically pure shear. Further, in the joint the tin has alloyed with the copper of the brass or zinc of the galvanized iron, and when the solder layer in a joint is very thin it is probable that most if not all of the tin has alloyed with the copper or zinc producing an alloy of different characteristics from that of the soldering material.

For a given solder and material to be joined, at least of the types studied, there appears to be a definite static load below which the joint will not fail. The failure of a soldered joint at a static load below the critical stress appears to be due to imperfect adhesion, the inclusion of air bubbles or other faults of workmanship. Because of the inability to make adequate inspection or tests of the workmanship in a finished soldered joint very large factors of safety must be used if it is vital to avoid failure of the joint.

Soldering Zinced (Galvanized) Iron

Q.—What is a good method of soldering galvanized iron and what solder should be used? We are at present using 50-50 solder (tin-lead) and strong hydrochloric acid to clean the galvanized iron before soldering. We find, however, that after about a month, the solder in the corners of the galvanized box, which we are making, crumble.

A. 1.—It is necessary that the surfaces to be joined be perfectly clean and means must be provided to prevent oxidation during soldering oxides tending to prevent interfusion. Chloride of zinc is the flux commonly used on galvanized iron. The flux is added first and the solder melted by means of a flame or soldering iron. In all cases where zinc chloride is used as a flux the article should be cleaned after soldering to prevent subsequent corrosion.—P. W. Blair.

A. 2.—If the iron is clean, raw acid is not necessary. In due course of time the acid works under the galvanizing where the metal is trimmed at the edges, loosening the galvanizing from the iron and then the whole thing comes away.

Would suggest that a non-corrosive soldering paste be used which will undoubtedly overcome the trouble.—W. L. Abate.

A. 3.—The reason why strong hydrochloric acid is the flux usually used in soldering hot galvanized iron, is that the surface is always composed of zinc oxide and zinc carbonate.

The hydrochloric acid dissolves these and forms zinc chlorides; some of the metal itself is also reduced. The total is then a strongly acid zinc chloride flux. We suggest that you reduce the strength of the acid by adding 1 part aqua ammonia 26 deg. to 9 parts of acid by measure. More ammonia can be added if the results warrant such an addition. The addition of ammonia produces a strongly acid sal-ammoniac solution.

This may prove advantageous. Try it out. The brittleness of the solder that develops after a time, is due to the zinc that may get into the solder from the hydrochloric acid flux. It makes the solder short or brittle. Use a better grade of solder than half and half; preferably 1½ parts tin to 1 part lead.—C. H. Proctor.

Mechanical Problems

Written for The Metal Industry by P. W. BLAIR, Mechanical Editor

BENDING BRASS PIPE

Q.—We have received a number of job orders recently for the bending of brass pipe to specifications in medium weight and iron pipe sizes. This is used in brass pipe plumbing and is polished and nickel plated.

As we have no bending machine please advise us the best machine for this class of work that will take care of the different radii and diameters of pipe. Also the best method to employ without a machine.

A.—To bend brass pipe without flattening or kinking it at the bend the following method is recommended when no bending machine is employed. If it is not soft enough, anneal it by heating to a dull red at the place where the bend has to be made. Then allow it to cool off. Screw a cap or plug the end. Then fill with melted pitch or resin. When cold bend it in a suitable form but not over a hard edge or a sharp iron piece.

A good plan where special bending forms are not available is to bore a hole through a thick post or thick plank a little larger than the outside diameter of the pipe and bend the pipe over the edge of the hole a little at a time until the desired curve is formed. Remove the pipe from time to time and lay it over a template on the floor until a bend equal to that of the template is formed.

If pitch or resin is not available then the pipe may be filled with hot sand which must be packed tight throughout the entire length of the brass pipe and a plug driven in to hold the sand firmly in place. The sand is packed by beating the pipe with a soft wood block on the sides. When the bend is made the sand can be poured out of the pipe.

Consult the advertising columns of Metal Industry for manufacturers of bending machines.

BRAZING METAL

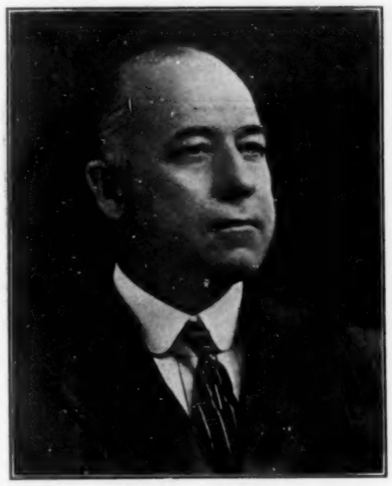
Q.—We desire a formula for a brazing metal, melting easily and flowing freely when the torch is applied and which will not blow away. We have tried an alloy of copper 50, zinc 50, also one composed of copper 52, zinc 47, tin 1. This is for brazing thin copper tubing into yellow brass castings.

A.—It appears probable that the difficulty is due more to the method of brazing than to the composition of the alloys. Both of these alloys have been used with good results. The blowing away may be due to the swelling of the borax in which case it may be advisable to use a mixture of soda ash and boric acid, finely powdered and stirred together. The following is a very fusible solder: copper 44, zinc 50, tin 4, lead 2.

Managing a Brass Shop

Problems of Personality and Finances in Running a Brass Manufacturing Plant

Written for The Metal Industry by W. L. ABATE, Brass Finishing Editor.



W. L. ABATE

This article has to do with the successful management of a brass shop. It may be applied to many other types of manufacturing, but there is perhaps no other line that has as much detail in its make-up as the brass industry. The manager of such a business has the entire control of the finances set aside for the use of this business and it is his duty to make a return in dividends commensurate with the size of the business or money invested. He must fully understand the financial side of the game and he must be a judge of human nature at first hand. He must also be a man of personal control, for in this business he will find many things to upset his poise and temper. Affability of manner, and honest dealing with both customers and employees are essential.

Now that we have a manager with qualities necessary for success, we place him in charge of our factory with full control and backing. We hold him responsible for results and give him a free hand. If the shop is an old one and in operation, his powers of endurance, control and affability will be tested immediately. If on the other hand it is a new venture, he has an easier time of it in that he can pick his own organization, and as he is first on the job, he will command greater respect from his employees owing to that fact.

Again, with a new business, it is much easier to grow up with it than to pick up the details of an outfit that has been going for years. This applies to all branches of the business including products, tools and machinery, employees and the general system around the office and factory.

Suppose that the articles for manufacture have been decided upon. It is now the duty of the manager to select his factory superintendent and he, like his superior, should have the same qualifications as to personal approach and control. In fact this is one of the chief assets of this successful brass shop. Disagreements arise from differences in the choice of machinery, tools, methods, metals, design of patterns and hundreds of smaller details that enter into manufacture of brass. It is here that the manager has his greatest opportunity in being able so to control the situation that all those affected finally come to his point of view without his showing partiality while in conference. The tactful manager never makes a snap judgment in such cases. When once partiality has been shown to any one party that party is looked upon with suspicion by his associates, and no matter if the particular thing under discussion turns out successfully when adopted, there is always the idea that it would have been better otherwise. It is in such places that the keen judgment of the manager must find a satisfactory way out of the problem quickly. Of course, once he has accepted a certain plan of procedure he must back it to the end and take the responsibility for its success or failure.

Outside of the manufacturing end there is the sales force to keep his attention. Competition is very close among manufacturers, and even though this manager is particularly well equipped with his organization to meet competition, there is a limit beyond which he cannot go to meet the declining price. He knows from his records what his cost is and he must have a profit. There are, perhaps, combinations made to keep prices up so that profits may be made, but somehow combinations do not hold and the purchaser has fixed his mind on the price he is going to pay, so the price is often made by the buyer and not by the manufacturer. The manager of our plant knows that his cost is as low as any and he is not asking an excessive profit. Therefore he knows that whoever takes the order is going to do without profit and absence of profits soon eliminates him.

It is as essential for him to have a competent salesman as it is to have his fine shop organization. The good salesman knows the limits which bind him and should never go beyond them or allow the buyer to dictate the price if he expects to hold his position for any length of time. Many buyers wait for a particular salesman to come around, knowing that they can browbeat him into accepting an order at a price below par. (This frequently applies to automatic screw machine products.) Since all shops have the same line of tools it remains with the organization to make the cost low enough so that the order may be accepted at a fair profit but never less. There are many shops accepting orders at cost on some articles and making profits on others. Just why a large part of many shops are making standard articles and selling them at cost, which is really at a loss, only the manager of these plants can explain. There are many brass shops operating so close to cost that they have not paid a dividend in years, and a good part of it is due to the fact of their taking certain orders at cost to keep the shop running full.

Each brass manufacturer seems to get an idea that he has the organization that can beat his opponent, for it is all in the organization and finances, and finances are not the most important of the two. Many concerns starting out with plenty of money have made a failure, due to the fact that they trusted in their money, while other concerns that have been short of money have been successful due to their organization.

Machining Duralumin

Duralumin can be turned and machined at practically the same speed and feed as brass. It does not seize or drag the tools as do some aluminum alloys. Kerosene forms a good tool lubricant in threading or finishing parts, leaving a clean-cut surface. A mixture of lard oil and kerosene in equal parts will be found useful for average work. When buffed, duralumin takes a fine polish similar to silver except that the surface lasts longer as it does not tarnish in the presence of a sulphuretted hydrogen and similar gases.—P. W. BLAIR.

Applications of Metals

A Practical Description for the Foundryman and User of Metals of the Industrial Applications of Metals and the Principal Uses and Properties of Their Alloys

Written for the Metal Industry by ERNEST G. JARVIS, President and General Manager of the Niagara Falls Smelting & Refining Corporation, Buffalo, N. Y.

ERNEST G. JARVIS

The science of engineering is of course based on physics and mechanics. To a great extent the materials employed are metals, and metallurgy and metallurgical engineerning have placed facts and figures before engineers so that it is no longer necessary to guess their uses and properties. Those facts which are known chemical properties, tenacity, ductility, malleability, hardness, electrical conductivity and resistance, density of grain, heat conductivity, anti-friction qualities, resistance to corrosion, color and finish can all be found in simple tables in most any book from the World Almanac to Kent's Handbook and the Smithsonian Physical Tables.

It is the intention of the author to explain the influence of the various metals on the foregoing properties and their effects under varying conditions.

COPPER

Copper is a well-known metal, distinguished from all others by its red color; it is one of the most widely diffused metals. In two regions this metal is mined in its native state, namely, on the south shore of Lake Superior, and in Bolivia, South America. Copper melts at 1996° Fahr., and its specific gravity 8.8; copper can be rolled, drawn or wrought; it turns easily in the lathe.

The basic element of all bronze mixtures is copper and it is usually regarded as a softener, imparting malleability, ductility, conductivity and toughness. It increases the tensile strength and particularly increases the elongation or ductility. Also, it increases the frictional resistance and hence, if the proportion of copper present is too high when subjected to fast speeds or heavy pressures, a serious rise in temperature may result.

Copper is widely used for electrical wires, on account of its high electrical conductivity. Next to silver it is the best conductor known; it is also very extensively used as a constituent of alloys with tin, zinc, lead, nickel, aluminum, etc. Copper is sometimes used for the tubes of condensers, and for other tubes where iron and steel are rendered useless by corrosion. It will stand high pressure and yet be flexible. Copper is used for roofing and sheathing on account of its high resistance to atmospheric corrosion. Copper is malleable and ductile. When cast it has a tensile strength of 25,000 per sq. in. When cold rolled and cold drawn the tensile strength may be increased to from 40 to 60,000 per sq. in. depending upon the mechanical working. This strength may again be reduced by annealing.

Copper may be termed the base metal, for with zinc is forms brass and alloyed with tin, the product is bronze.

TIN

Tin is next in importance since its use in graduated percentages increases the hardness to any degree desired. Corresponding with this decided hardening tendency of tin, the tensile strength is increased and the elongation reduced. It forms a homogeneous mixture with a resultant fine-grained metal, susceptible to heat treatment. It increases the shrinkage in casting and lowers the melting point. The tensile strength of tin is about 4,580 pounds per square inch. Its specific gravity is 7.4 and the melting point is 446° Fahr.

Tin is a metal nearly resembling silver in whiteness, weight and luster; it is highly malleable and takes a high polish. Among its chief uses are coating sheet iron, and making alloys with copper and other metals.

LEAD

Lead is a metal remarkable for its softness and durability; it belongs to the white metals, but has a decided bluish gray tinge; the fresh cut surface is lustrous, but soon becomes dull from exposure. Lead is easily cut with a knife and is very malleable; it can be rolled into sheets, but will not draw into wire; it is largely used for pipes and steam joints. Lead used in bronzes reduces friction, and hence where two surfaces are in sliding contact, the tendency to overheat is counteracted. With copper, lead contributes a degree of softness which enables compositions, otherwise machined with difficulty, to be readily tooled. Lead does not alloy perfectly with copper, and particularly in large percentages, a homogeneous mixture, necessary for the production of sound castings, requires the use of artificial means to induce a quick setting of the structure. This is sometimes accomplished by the use of the proper percentage of some non-injurious element, having a higher melting point than the bronze or better, by mechanically setting the metal at the time of pour. Unless rapidly cooled in this manner, lead very materially decreases the tensile strength and elongation. The tensile strength of lead is about 1,780 pounds and the compressive strength 3,890 pounds per square inch. The specific gravity is 11.37, and the melting point is 621° Fahr.

ZINC

Zinc in combination with copper forms the well-known alloy, brass. Zinc, except in the special, so-called bronzes, wherein the zinc content is very high, is used mainly as a flux. It closes the grain and softens, therefore lowering the tensile strength, but increases the elongation. Due to this effect and its rather high co-efficient of friction, it heats easily under pressure and is undesirable in bearings except in small percentages. In large percentages it is not easily filed or machined. It does not alloy with lead and hence its use should be limited when this element is present. Zinc has a tensile strength of about 6,200 pounds and a compressive strength of about 33,500 pounds per square inch. Its melting point is 786° Fahr.

BRASS

Brass is an alloy composed of copper and zinc in different proportions; it is harder than copper and wears better than that metal; it can be rolled into sheets or hammered into any shape, and drawn into fine wire; it turns easily in the lathe. It melts at 1650° Fahr. Brass is of different degrees of hardness, according to the proportions of the constituents.

MUNTZ METAL

Muntz metal is an alloy of three parts copper, two parts zinc, largely used for sheathing timber ships' bottoms to preserve them from the action of salt water. It can be easily rolled or forged, and differs from common brass in being malleable when hot.

DELTA METAL

Delta metal is an alloy of three metals (Delta signifying three-sided or triangular). Its component parts are copper, zinc and iron. Delta is non-corrosive, and capable of high polish; it can be cast, forged, stamped, and rolled; it has great strength and toughness; when rolled it considerably exceeds the tensile strength of rolled bar iron. For mines it presents advantages by its resistance to acid waters.

COMMONLY USED BRONZES

The most commonly used bronzes, with the variations introduced by different manufacturers, include a wide range in mechanical properties, but may be summarized under the headings of gun metal bronze, phosphor bronze, steam metal, bronze, aluminum bronze, Tobin bronze, manganese bronze, silicon bronze and bearing bronze.

One of the most interesting of the true bronzes, and one largely specified by the United States navy and ordnance departments, is commonly known as gun metal bronze, from the fact that it was formerly largely used for gun castings. It is composed of about 88 per cent copper, 10 per cent tin and 2 per cent zinc. Its tensile strength, normally, is about 35,000 pounds per square inch, with an elongation of about 16 per cent.

Even with good practice, however, these physical results are all widely variable and depend in a large measure upon the method of casting the test bar, that is, in size, shape, weight of riser and rapidity of chilling.

PHOSPHOR BRONZE

Phosphor bronze is a very important member of this group and is divided into two classes, designated as hard phosphor bronze, and soft phosphor bronze. The hard phosphor bronze, usually is composed of about 89 per cent copper, 10 per cent tin, and 1 per cent phosphor copper. Normally its average tensile strength is about 33,000 lbs., its elongation 15 per cent, and reduction of area, 12 per cent. It resists repeated stresses well, showing little fatigue after undergoing heavy loads. This bronze is used for valves and pumps required for oil refining, and in chemical processes where resistivity to the action of acids is demanded. It also is widely used for general work for which it is well fitted by its high strength combined with ready workability, for it can be rolled, cold drawn and forged, as well as cast. This same bronze, when alloyed with about 0.5 per cent more phosphorus becomes quite hard and is then used for cog and worm wheels, high speed bushings, slide valves, etc.

The soft phosphor bronze is composed of 80 per cent copper, 10 per cent tin and 10 per cent lead. Its normal tensile strength averages 28,000 lbs. per square inch; elongation, 6 per cent in 8 inches, and the reduction of area on bars of this metal is about 5 per cent. It is used to a large extent as a bearing metal.

STEAM BRONZE

Steam bronze usually contains about 85 per cent copper, 5 per cent zinc, 5 per cent lead and 5 per cent tin, although each of these percentages can be varied by 1 to 3 per cent, depending upon the properties which is desired in the bronze. Its tensile strength varies from 26,000 to 32,000 pounds per square inch; elongation from 16 to 22 per cent, and reduction of area from 20 to 25 per cent. As the name implies, it is used for general steam work, that is, for mechanical parts which are used with saturated steam pressures. When correctly made it is a thoroughly reliable and homogeneous metal for all around work, on account of its ductility; furthermore it casts well and takes a good color and finish. It also is largely used for automobile parts and is probably more used than any other alloy known.

ALUMINUM BRONZE

There are several special bronzes which are coming more and more into general use for specific purposes, as their properties become better known. Of these, aluminum bronze, containing 95 per cent copper and 5 per cent aluminum is excellent on account of its great strength and ductility at high temperatures.

Its tensile strength normally averages 35,200 pounds, with an average elongation of 56 per cent and an average reduction in area of 47 per cent. One great advantage of this bronze is that even at a temperature of 600° Fahr. the elongation drops only to 45 per cent, and the tensile strength to 24,300 pounds, which is in marked contrast to the other bronzes. On this account it is used for superheated steam, valves and fittings. This bronze also is used for seamless tubing, since it can be worked at a bright red heat. It can be rolled, swedged, spun or drawn cold. By increasing the aluminum content to 11 per cent, a tensile strength as high as 100,000 pounds per square inch may be attained with an elongation of 8 per cent.

By the addition of a small percentage of titanium to well made aluminum bronze a strong, tough bronze is produced, having a tensile strength of 70,600 pounds per square inch; an elongation of 14 per cent and reduction of area of 15.3 per cent. This is said to be excellent for gear blanks and is coming rapidly into use for this purpose.

MANGANESE BRONZE

The commercial manganese bronze generally referred to when this term is used, is also a misnomer, in that its principal elements are copper and zinc. By analysis, this contains 57 per cent copper, 41.40 per cent zinc, 1.20 per cent iron, 0.75 per cent tin, 0.50 per cent aluminum, and 0.15 per cent manganese. Although different manufactures vary these percentages, slightly, in fact some analyses show no manganese whatever, the small percentage of this element originally added being oxidized out of the bath of metal. However, its physical properties place it in the front rank of bronzes for certain purposes. The tensile strength, when properly alloyed, is not less than 60,000 pounds per square inch, the elongation is not less than 20 per cent and the reduction of area is over 25 per cent.

It is used for automobile shock absorbers, wheel gearing supports and connections of machines, the shells of main and other bearings for engines and sheave wheels, but perhaps the greatest tonnage of this alloy cast is in the form of screw-propellers for steamships and underground hydraulic shapes, where its resistance to corrosion adds to its value for these purposes. Like aluminum bronze, it has a high shrinkage.

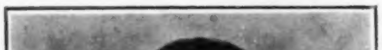
This article will be continued in an early issue. —Ed.

Door Knockers

Ancient and Modern

Written for The Metal Industry by A. F. SAUNDERS, Designer, Benedict Manufacturing Company.

Off hand one might believe, in this age of electric appliances, that the push button had relegated the old door-knocker to the shelves of antiquity. To the contrary this useful and decorative article in metal is produced in larger quantities than ever before. It can even boast a far wider range of patterns than were known in olden times, before bell pulls or electric push buttons were thought of.



A. F. SAUNDERS

Seldom indeed do we find productions of former periods in art adapted to modern use in their original form; especially in the case of house furniture and implements. Two striking exceptions, however, are the door knocker and the andiron, both of which are susceptible to artistic decorative treatment. Fundamentally the door knocker is the same today as it was in medieval times. Artistically it has passed through several stages of development, reaching its finest form during the Florentine period of the Renaissance in the 16th century. It is made almost exclusively of bronze, brass or wrought iron. Its dimensions are variable, like those of the doors and gates themselves, to which it should bear some proportion.

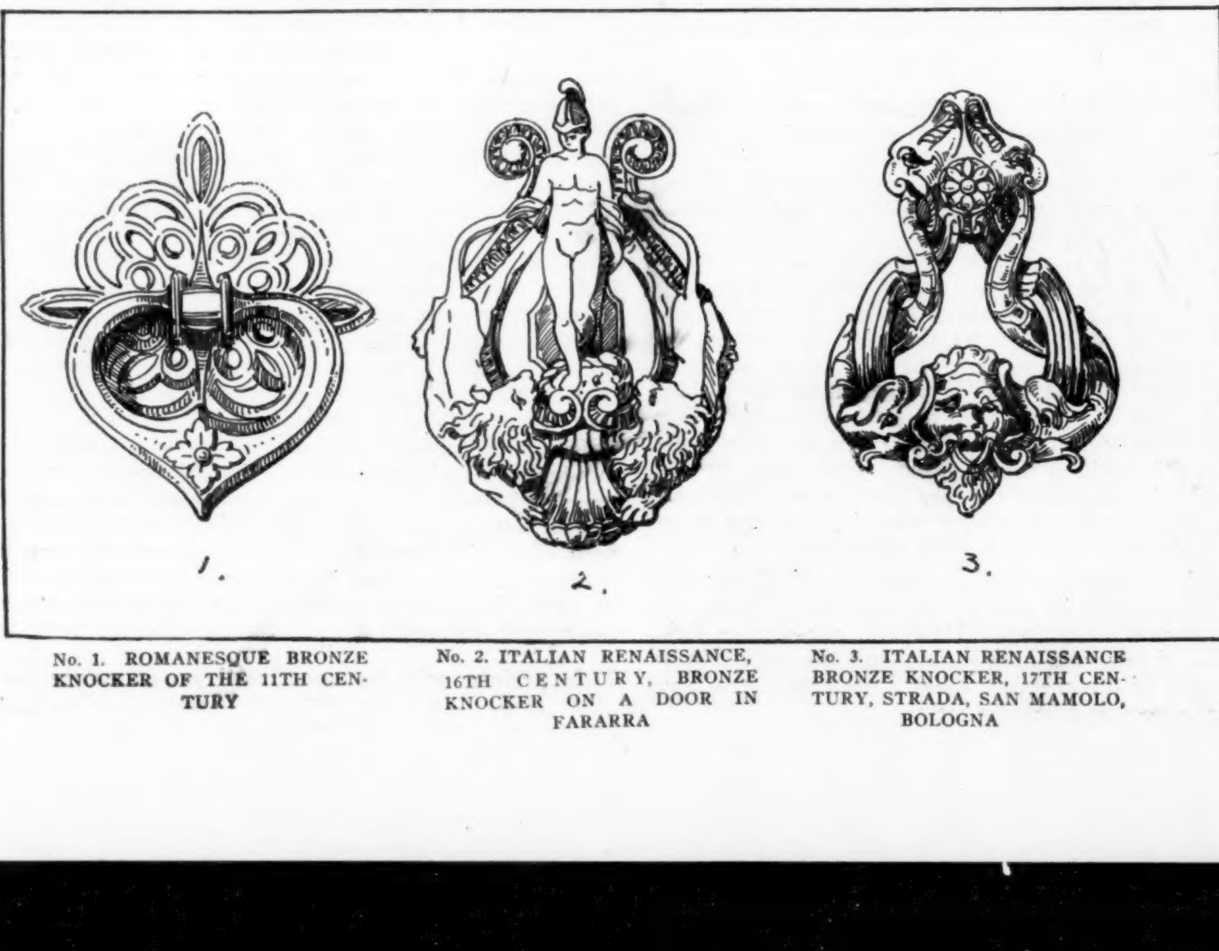
STYLES OF DOOR KNOCKERS

Door knockers are divided into three classes or styles. The first has the form of a ring, the earliest type serving not only as a means of communication but also as a handle for moving the massive door itself. The ring is suspended from either a flat back plate, usually pierced (as made in the Romanesque and Gothic types) or from some floral, geometric, or grotesque ornament, like lion's jaws, etc. The second type has the form of a hammer movable on a primitive hinge, after the style of the illustration of the knocker on the old John Hancock House in Boston. This type is of English origin, reaching its highest artistic development about the time of William and Mary. It became a very popular style of knocker during the American Colonial period. The third class which arose in Italy in the best days of the Renaissance, was very elaborate in design. The human figure, full length or in part, various animals, the serpent and dolphin, often combined with florated scroll work, formed the principal decorative motifs. The illustration of the Sixteenth Century Italian bronze knocker from a house in Ferarra is typical of this type, and is a splendid example of the fine foundry work of that period.

KNOCKERS OF VARIOUS PERIODS

In all three classes the requisite noise is produced by the movable part falling on a metal stud. In the third class it is well to note that the back plate by which the knocker is affixed to the door is of secondary importance, whereas in the two former classes it is often the principal feature of the design. During the fourteenth and fifteenth centuries, the ring is flatter and broader, finishing in a point toward its lower end and often decorated with flamboyant tracery. The contours of the tracery were frequently relieved by red or blue parchment or cloth placed behind the pierced ground, traces of which are often found in ancient works of that age.

On the decline of Gothic art, during the time of



No. 1. ROMANESQUE BRONZE KNOCKER OF THE 11TH CENTURY

No. 2. ITALIAN RENAISSANCE, 16TH CENTURY, BRONZE KNOCKER ON A DOOR IN FARARRA

No. 3. ITALIAN RENAISSANCE BRONZE KNOCKER, 17TH CENTURY, STRADA, SAN MAMOLO, BOLOGNA

medieval extravagance, when conventional tracery and mullions degenerated into natural ramifications and scroll work, the knocker was of course, subjected to similar treatment. Following the tendency of late Gothic art, it was sometimes transformed into a mere architectural structure, taking at one time the shape of a hook affixed to mountings decorated with tracery, at another even that of a castle tower with battlements and parapets and other decorations.

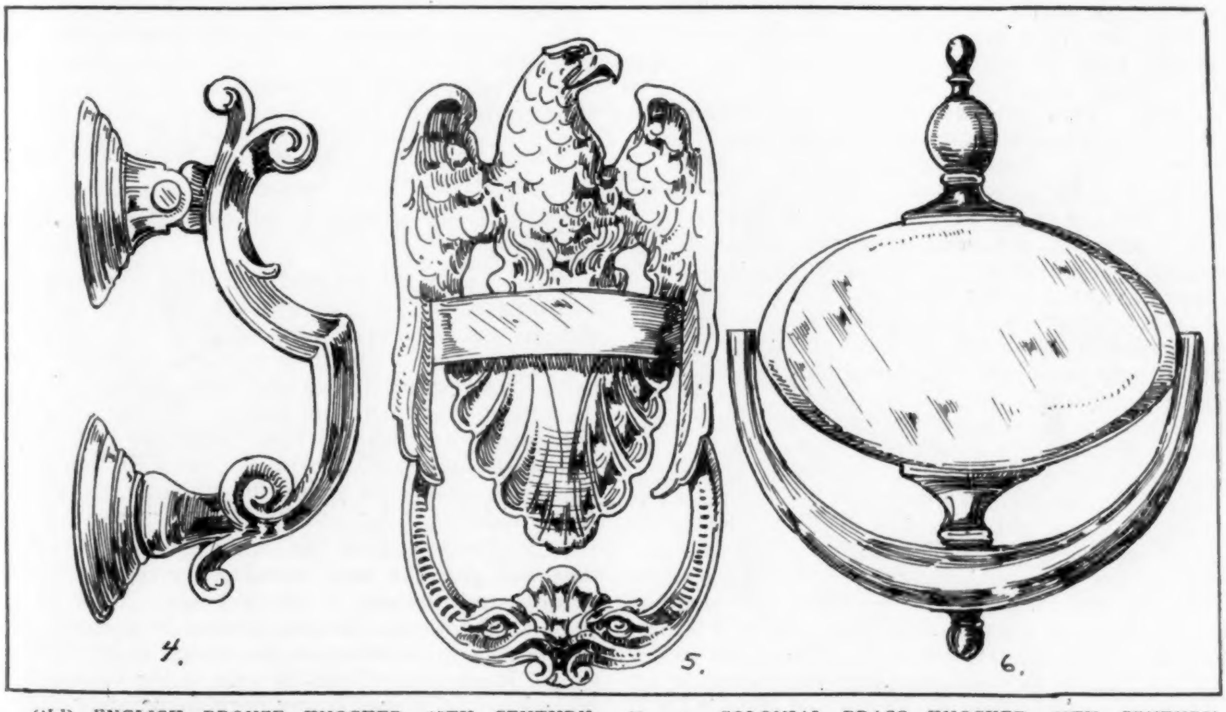
The early Renaissance period preserved the form of the ring as shown by numerous examples on the doors or gates of many houses, churches and sacristies in Italian towns, but it was during the Florentine period that art bronze work reached its highest development and door hardware, including the knocker, came in for its share of artistic attention. It was during this period of remarkable development of art in general, that such masters as Giovanni da Bologna, 1524-1608, raised the art of metal work to its highest degree of excellence. It is true that only a few door knockers still extant can be ascribed to him. Still he was the center of a set of artists to whom, working in the same spirit, we owe many excellent productions. The artistic conception of these works is generally characterized by the grouping of human and animal figures, of masks and emblems into the form of a ring, or freely combined in some other arrangement, in which particular regard was paid to the considerable weight necessary for the functions of the knocker. The same hand that devised the knocker has often decorated the whole door, and principally the lock plate gives frequent occasion for display of the artist's fancy.

In England the door knocker developed along more simple lines, though massive in form. The hammer type (Fig. 4), predominated. Scroll forms, flutings, and the lion's head were the usual motifs used. During the Georgian period the metal work followed the influence of the classic feeling of the Adam, Sheraton and Chippendale styles. This same spirit of refined decorative treatment is characteristic of the fine old door knockers of the American Colonial period, reproductions of which are and should be in such great demand at the present time.

I was surprised, while visiting the City of Chester, England, last summer, to note the great number and variety of door knockers to be seen there. Practically every home in that city has a door knocker. I spent one entire afternoon rambling about the town looking up these interesting examples of the art of the brass foundry. I counted in my ramble over one hundred and fifty different patterns in design, ranging from a simple ring and back plate to several, very handsomely modeled in relief. One very handsome one represented the head of the goddess Diana. Another one, more amusing than beautiful, was a grotesque figure of the famous "Cheshire Cat," and still another the old English symbol of good luck, the "Lincoln Imp." Several other designs such as a basket of fruit or flowers, a lion's head, with a festoon of laurel forming the ring suspended from its jaws, were fine examples of the art of casting. Many old door knockers have become famous, their designs forming the basis for reproductions in almost unlimited quantities. Some are noted as examples of the finest in artistic conception, such as the beautiful knocker from the Pisani Palace at Venice which represents Neptune holding his trident, and two rampant sea horses. Another fine one shows David with the head of Goliath, flanked by two lions. It decorates the massive door of a house in Fararra, Italy. Both of these knockers are masterpieces of art in bronze.

Foremost among early American patterns is the American eagle. While the bird is always shown with its wings in a spread position, there are several variations in design. One is an exact reproduction of the coat of arms of the president. Another shows the upper part a spread eagle, the lower part in the form of a shell, the knocker formed of a pair of dolphins.

The massive English hammer type of brass knocker illustrated was developed during the William and Mary period, 1689-1702. It was known as the Cape Cod knocker in the Colonies and is the pattern found on the doors of such famous homes as Washington's, Longfellow's, Webster's and Hancock's.



No. 4. OLD ENGLISH BRONZE KNOCKER, 17TH CENTURY, JOHN HANCOCK HOME, BOSTON

No. 5. EARLY AMERICAN BRASS KNOCKER, 18TH CENTURY, FAMOUS AMERICAN EAGLE TYPE

No. 6. COLONIAL BRASS KNOCKER, 18TH CENTURY, OLD CHATHAM PATTERN, THIS DESIGN HAS BEEN REPRODUCED PERHAPS MORE THAN ANY OTHER OF THE OLD COLONIAL PATTERNS

Chemical Analysis and the Electro-Plater

The Value of Chemical Analysis and Its Limitations in the Plating Plant. Other Measures Necessary for Scientific Control

Written for the Metal Industry

By JOSEPH HAAS and ELMER R. UNRUH

JOSEPH HAAS

For several years the electro-plater has heard that a knowledge of chemistry would be of great benefit to him. These efforts have finally had effect, so that today electro-platers are taking a great interest in chemistry. Their efforts are particularly directed to learning to analyze their plating solutions to keep them of a constant composition. The axiom is uniform conditions will give uniform results. So from the title, one would be led to assume that a wonderful cure-all was to be found in analyzing plating solutions, and that it is to be fully explained. If such is the expectation, disappointment is sure to result. If chemical analysis is not going to keep the plater out of trouble, what then, may be asked, is the value of chemical analysis? By itself, chemical analysis is of little practical value to the plater. This is as true as in the days when the mere possession of a formula was thought to constitute all the requirements of successful electro-plating.

Many, in following chemical analysis of plating solutions, soon come to the point where they are more perplexed than they were before, due to the fact that they have blindly gone through an analysis, expecting a magician to appear who would signal them the source of their trouble. Others believe that a chemical analysis alone means an absolute solution of difficulties, such as peeling and pitting. Such difficulties might be solved by an analysis alone, but most probably would not. Chemical analysis is but one factor in the control of plating solutions, and probably the least important, because any chemical analysis will show only the approximate and not the ultimate condition of the solution. And that is an important point. Generally in making a chemical analysis of a plating solution, an effort is made to determine the amounts of only those substances originally added. According to the analysis the solution may be correct and yet unsatisfactory deposits may be obtained, due to decomposition products of chemicals originally added, or an accumulation of impurities either in the original chemicals, or resulting from methods of production. What these decomposition products and impurities might be, the determination of maximum permissible amounts, their elimination or reduction, as determined by analytical methods is far more important than the determination as to whether the present composition is the same as the original. However, original composition is not to be entirely ignored.

Successful results in electro-plating will depend upon many conditions. How they are named and classified will depend primarily upon the point of view taken. Our aim is to show that successful results are obtained by what would be called "scientific control." In one way the title "Chemical Analysis" is misleading as can be proven by anyone who has tried to operate his plating solutions by paying attention to the analytical side only. What then must be considered? Obviously electricity or current conditions, as without it electro-deposition cannot take place. Upon casual reflection one would be led to conclude that if the composition were kept constant and electrical conditions uniform that would cover all the subject of scientific control. Again we would not be covering enough territory.

SCIENTIFIC CONTROL

What then, may be asked, constitutes scientific control, and wherein is its value in obtaining uniform operation of plating solutions and uniform results in electro-deposition? Scientific control will include the following:

1. Chemical analysis of plating chemicals and solutions.
2. Regulation of electrical conditions.
3. Records, conscientiously kept of performances and results.
4. Experimentation with solutions under varying conditions.
5. The proper interpretation of 1, 2, 3 and 4 collectively.

WHAT CHEMICAL ANALYSIS OF PLATING SOLUTIONS WILL DO

The regular analysis of plating solutions will enable the plater:

(1.) To determine and maintain solutions of such a composition that they operate most efficiently under definite current conditions, temperature, and mechanical operations. The most efficient operation will depend upon circumstances and undoubtedly will vary in the various manufacturing plants. The efficient operation will not be that with which the plater can just get by, but will be the best results (with due consideration to costs), that he is capable of giving his employer regarding uniform thickness, color and quality of deposit.

(2.) To determine the composition of the solution that will give the most satisfactory results as regards quality and texture of the deposit. Very often the amount of a certain chemical present in a plating solution will have a great effect on the nature of the deposit. A simple illustration of this is seen in the operation of an acid copper solution. Under normal operating conditions, the presence of sulphuric acid up to six ounces per gallon will produce a relatively soft copper deposit, while sulphuric acid present in amounts of from eight to thir-

teen ounces per gallon will produce under normal operating conditions a hard, fine grained deposit. Another illustration can be seen in the operation of a cyanide zinc solution. An appreciable excess (four to six ounces per gallon) of cyanide or alkali is desirable in a cyanide zinc solution as it tends to produce finer deposits, but a large excess is likely to cause porous or spongy deposits. Hence, by keeping free cyanide or alkali within certain limits by chemical analysis we can produce a fine grained deposit without the danger of getting too large an amount of free cyanide or alkali and producing a spongy deposit.

(3.) **To determine the composition of the solution that will give the most efficient operating conditions.** In order to have a solution operating efficiently, we must have every ampere passing through the solution liberating or depositing the maximum amount of metal possible. That is, no electrical energy must be wasted or dissipated in the solution by overcoming needless resistance or depositing gas (hydrogen). An illustration of this can be seen in the operation of a cyanide copper solution. The amount of free cyanide in a cyanide copper solution, if low, causes poor anode corrosion, the anodes become coated and anode polarization is increased. Hence, it requires a higher voltage to secure the desired current density. Too great an excess of free cyanide causes a decrease in cathode efficiency and a very large amount of hydrogen is deposited with the copper. By means of a series of chemical analyses we can determine the limits of free cyanide in a cyanide copper solution so that enough free cyanide is present to prevent current from being wasted overcoming anode polarization, and not enough free cyanide is present to cut the cathode efficiency below its normal value.

(4.) **To determine the amount of foreign or objectionable substances that are permissible for a satisfactory deposit and efficient operations.**

Copper and zinc are two objectionable substances found in nickel solutions. They enter the solution through additions of nickel salts; from incomplete rinsing of work placed in the solution, the work having been previously plated in a copper solution; or from brass work dropped in the solution from plating racks and remaining on the bottom of the tank.

Small amounts of zinc tend to cause bright edges and smooth surfaces. Larger amounts will bring out bright lines, spots, and patches on the surface and tend to increase pitting. Excessive amounts will cause a characteristic loose, black, scaly deposit.

Small amounts of copper tend to cause a slight roughness near the bottom of the cathode, caused by scattered dark trees or burrs. Large amounts cause this roughness to spread up toward the top. Excessive amounts cause a heavy, spongy, dark gray deposit at the bottom.

The observations made on nickel solutions controlled by chemical analysis showed that the permissible amount of zinc (providing no copper is present), to be allowed in a nickel solution is about 0.3 grams per liter, or 0.04 ounces per gallon, and the permissible amount of copper (providing no zinc is present), is 0.04 grams per liter, or 0.005 ounces per gallon. However, it has been found that when both impurities are present, the zinc counteracts or neutralizes the bad effect of the copper, providing that the amount of zinc is far in excess of the amount of copper. We have found, in producing light nickel deposits, that when the ratio of copper to zinc is about one to ten, a concentration of .02 ounce copper per gallon and 0.20 ounce zince per gallon can be reached before trouble will be experienced.

When either or both of these impurities reach this permissible concentration in the solution they must be removed or trouble will soon be experienced.

Hence, by a regular determination of zinc and copper in a nickel solution we can anticipitate when trouble will be experienced and when these two substances must be removed from the solution.

(5.) **To eliminate all guess work in making additions to solutions to keep them in proper working condition.** It is very hard to estimate the amount of chemicals necessary to add to a plating solution at the end of the week so that the solution will be in proper condition for the next week, especially if the solution has not been worked continuously all the previous week. In the case of solutions which were only worked intermittently and were analyzed every week we found that it was almost impossible to approximate the additions to make. Most platers in making additions to their plating solutions without the aid of chemical analysis try to play safe by adding enough chemicals with the result that the solutions become saturated with some of the less soluble salts (such as boric acid in case of nickel solutions) crystallize out on the anodes, sides and bottom of the tank. This is not only a waste of chemicals, but decreases the electrical efficiency of the solution by coating the anodes and increasing the anode polarization. As the concentration of the solution increases so does the value of the "drag out" of the solution until the point is reached where the value of the "drag out" is more than the value of better working part of the solution, due to high concentration. So a regular chemical analysis will not only eliminate guess work in making additions to solutions but will assure full value from all chemicals added and reduce chemical cost of operation of the solution.

(6.) **To standardize one factor which might cause bad results—solution of unsatisfactory composition—and thereby lessen the time consumed in remedying solution.** Bad results in plating are usually caused by a solution of unsatisfactory composition, poor operation, poor electrical conditions, or poor work surface. By keeping the composition of the solution the same we can usually be sure when bad results appear that they are due to one of the other general causes, and we can set out to trace the trouble immediately. If no chemical analysis has been made on the solution and we do not know that its composition was satisfactory, the first thing to do is to determine the composition of the solution, which in case of some types of solution would consume much valuable time, during which the solution is either out of use or producing bad work.

WHAT CHEMICAL ANALYSIS WILL NOT DO

Regular chemical analysis will not:

1. Eliminate all trouble in the plating room, as trouble may be due to poor operating, poor electrical connections, or poor quality of work sent to be plated.
2. Eliminate trouble due to the human element. But, as most trouble is caused by either the solution or the human element, by keeping the solution uniform, the human element can be taken care of.

This article will be continued in an early issue.—Ed.

Aluminum Alloy Corrosion

Passification and Scale Resistance in the Corrosion of Aluminium Alloys," by L. H. Callendar.*

These experiments tend to show that the action of chlorides is to reduce the resistance and adherence of the resistant scales, and that carbonates tend to increase scale resistance.

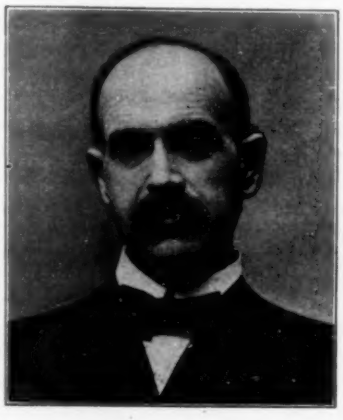
It would appear that this electrochemical method of experiment might be usefully applied to the investigation of factors influencing the corrosion of other metals and alloys besides aluminium.

*Abstract of a paper read at the meeting of the British Institute of Metals in Glasgow, Scotland, September 1-4, 1925.

What Is a Durable Deposit?

A Discussion of This Question from Various Angles

Written for The Metal Industry by W. S. BARROWS, Foreman Electro-Plater, Toronto, Canada



W. S. BARROWS

Since the electro-deposition of metals became of commercial importance, the question, "What constitutes a durable deposit?" has met with varied expressions of opinion from practical men. This is still the case today. There are reasons for this condition, one of which is that many platers do not interest themselves in the requirements of any other line of goods than that which they process. For instance, a novelty goods plater will possibly write an article on electro-plating and state that in his opinion nickel deposited in five to ten minutes should be of sufficient protective value for ordinary purposes, and that deposits which are allowed to progress to the point of turning from a blue tone to a white shade are unnecessary and a waste of material and time. He may also add that more buffing compound is required to color such deposits and final results are no better. Now, Mr. Meddlemaster, manager of the National Out-of-Door Vehicle Company, reads the article, passes it on to his factory superintendent with a memo to the effect that he thinks they are plating their goods too long. The superintendent takes the matter up with the plater who has learned to do as commanded and a reduction in the plating period follows. In the above we give a reason, a cause and an effect. Usually such effects prove very unsatisfactory to someone and the customer is possibly the first to suffer. Novelty goods have certain conditions to meet which may be well guarded against by a mere film of some hard or non-corrosive metal, but we are not all in the novelty goods business. Another plater, superintendent, manager or equally important officious individual may contend that a product which is constantly or very frequently exposed to atmospheric influences, mud and water, yet not in any way subjected to friction, is quite as well protected by a thin deposit as by a heavy one or that a heavy deposit is in every way unnecessary, likely to peel and cause more trouble than a thin coating.

It is not the intention of the writer to attempt settlement of this question, but rather to try to impress the younger platers particularly with the fact that we should all exhibit a careful, thoughtful attitude toward the question of durable deposits. The result of the work of the United States Bureau of Standards so far with reference to protective value of nickel deposits, alone is sufficient to warrant careful study of the requirements needed in each plant to produce better and more durable electrodeposits. A first-class protective coating on one product may be only a beginning on another. To deposit .002 of an inch of metal on any cheap novelty work would be sheer nonsense, while the other extreme on high grade iron or steel products would cause dissatisfied customers and loss of trade.

When treating iron or steel we must consider the tendency of these metals to rust. Rust with reference to iron is in reality an oxide or peroxide of iron which when once formed on the surface of iron, even in minute quantities, continues to increase in volume and corrosion deepens until eventually a scar or cavity is the result. The effect being same as the gradual eating by a virulent ulcer on the tissues of the human body. A mere finger mark left by a careless workman may form the nesting place of a multitude of active, destructive molecules of red rust and finally develop into a hideous blemish. While conducting some experiments recently the writer had occasion to use a number of small pieces of sheet steel. The pieces were all given a grease wheel finish, cleaned and dried. Further progress was delayed for about two weeks. In the mean time rust developed on the surface of the steel pieces. Some spots were barely visible to the naked eye. Others could be felt by passing a finger over them. Three spots out of a total of twenty-one which were studied, possessed circular centers with a speck in the center of the circle. The majority of the spots were more or less irregular and the direct cause rather difficult to determine. The round spots with fine lines were identified as finger marks.

We decided to use the steel pieces for a different experiment than they were prepared for. To carry out our experiment we required dry rust and set about to get it from a large rust coated casting which had been lying against a steam radiator for at least six months. Dust arose from the casting and box into which the rust dropped as we scraped it off. To assure ourselves that the dust was dry, we placed it under a microscope of ten magnifications and could easily discern globules of moisture. The rust was placed in a porcelain dish and dried in an oven, then sprinkled on each of two of the steel pieces. Five pieces of the rusty steel were passed through an electro-cleaner and immersed for ten seconds in a 15 per cent solution of muriatic acid and water at a temperature of 80 deg. F. Five pieces of the rusty steel were cleaned in same manner as stated above and immersed for ten seconds in a 25 per cent solution of sulphuric acid and water at 120 deg. F. Five pieces were cleaned in same manner and immersed in undiluted sulphuric acid for ten seconds. Temperature of acid was 145 deg. F. Four pieces were cleaned same way and immersed in strong oxalic acid for five minutes. All specimens were rinsed in cold running water after the acid treatment. Pieces sprinkled with iron rust were only cleaned and rinsed before iron rust was sprinkled on the steel; then carefully lowered in a nickel solution in horizontal position so as not to disturb the rust unnecessarily. Coarse dust was carefully blown off. All acid treated pieces were then placed in the same nickel solution and a current approximating three amperes per sq. ft. at a voltage of 1 2/5 was passed through the bath for one and a half hours. No selection of pieces was made previous to acid treatment. After plating, the pieces were rinsed and dried, then suspended on threads in a wooden box which was closed and placed in a cold damp corner of the factory warehouse. After remaining undisturbed for fifteen weeks (September 8, 1925, to December 23, 1925) the following conditions were found: Pieces immersed in 15 per cent solution of muriatic acid—ten seconds. Nickel deposit raised badly in vicinity of original rust spots. Pieces immersed in 25 per cent solution of sulphuric

acid, ten seconds. Nickel deposit not disrupted, but effects of increase in volume of rust easily noticeable. Inspection with magnifying glass revealed indications of rust penetrating the deposit. Pieces immersed in undiluted sulphuric acid, ten seconds. Nickel deposit in good condition. Inspection with glass failed to reveal any evidence of damage to nickel deposit by rust. Pieces immersed in strong oxalic acid, five minutes. Nickel not injured; no evidence of rust revealed by magnifying glass.

The two pieces sprinkled with fine rust were almost completely separated from the nickel deposit over the entire surface treated with rust. The steel was practically covered with a thick coating of iron rust; the nickel deposit was merely a fine sieve, so numerous were the fine holes caused by the fine particles of iron oxide. The writer has been interested in the preparation of steel and iron for electro-plating for thirty years, but was able to learn a few points from this chance experiment.

Hoping that others who are interested likewise may obtain some benefit from it, it is passed on for what it may be worth. It apparently verifies the statement often made that chemically clean metal surfaces are essential if adherent deposits are desired. And rust in minutest quantity is dangerous when given certain acid treatment. It also convinces us that the safest acid to employ is sulphuric acid. Someone has said that muriatic acid is the logically correct acid to use in preparation of steel or iron for plating. The writer is anxious to confirm that statement, but has never been able to do so to his satisfaction by any practical test.

German Plating Practice

Impressions of German Plating Plants as Seen by an American Electro-Plater.

Written for The Metal Industry by OSCAR G. SMIDEL, Electro-Plating Engineer, Chicago, Ill.

The first large institution that I visited was the A.E.G. (Algemeine Elecktrizitets Gesellschaft). This is the largest concern on the continent employing (when busy) 100,000 people. The plating and polishing room was well illuminated and clean. Their plating was done in nickel, copper, brass and a small vat of silver. The articles to be plated were cleaned with lye and pumice stone and the workmen, as I observed, had ample time; no piece work or rush there, just taking it easy. Their two generators were of about 1,200 to 1,500 amp. and clumsy looking things. I believe we in America have the most efficient and best looking plating dynamo (low voltage) in the world. The duration of plating was from 1 to 2 hours, and I emphasize the fact that it was well done. But what they lack is speed—production. This they must learn from us.

This large concern had no electric cleaner, no mechanical platers and never heard of an automatic plating conveyor. I placed before them a few sketches and photographs of our conveyors and they were interested, but could not make any improvements to increase production until conditions in Germany improved, meaning by this the lack of money. In order to meet competition of the "producing America," they must work longer hours, a ten-hour day, with very low wages. The salary of a foreman plater or polisher is about 200 marks per month, approximately $24.00 per week, and his assistants, of course, less. Living is the same as in America, coffee, tea, butter and fats being from 50 to 100 per cent higher.

I visited other shops in Berlin and other cities but found the same non-productive conditions.

While in Austria, I visited the Enzesfelder Munition Works, near Vienna, employing in the neighborhood of 12,000 people, but restricted through the Alliance. It is now manufacturing anything in metal. All the polishing lathes, (about 15) are belt driven. The polishers have a good time smoking while they work. There is no piece work. That would be insulting. Their motto is more play, less work. However, their work is good, and clean.

In the plating room they have a number of large tanks. Cathode and anode are the same as we have in America, but as yet I have not found more than one work rod in any large tank.

Their method of cleaning is with lye and pumice stone, and of course, scouring. They produce some very fine finishes which are dried in sawdust, and lacquered by hand.

In this plant I tried to get a job. I saw Herr Direcktor (General Manager) and told him that I would at least do 100 per cent more and put his plating and polishing plant on production basis. Everything was agreeable until I mentioned the salary. He then politely told me that he himself did not earn that.

In Hamburg, there is a large chandelier house, producing some very fine brown finishes in which I was interested, so I paid Mr. Doehrs a visit. I placed my card in his hand and begged if he would be kind enough and show me his method of plating, and wanted to reciprocate. Mr. Doehrs used a little strong language and finally said, "We are not going to show our art in plating to you stupid Americans." I then politely thanked him, and informed him that we do not need his art.

My conclusion is that we do not need Europe to learn the art of plating. If Europe wishes to produce, they must learn that from the United States. But we must learn cleanliness from Germany as their plating and polishing rooms are spick and span.

Platinum Solution

Q.—We are especially interested at this time in developing a suitable platinum solution for flash plating white gold watch cases. At the present time we are trying a mixed phosphate solution but have not been able to obtain satisfactory results.

We have what we believe suitable equipment for doing all kinds of plating work as we plate gold of all colors satisfactorily.

A.—One of the most efficient platinum solutions can be prepared as follows:

Water, 1 gallon
Sodium phosphate, 20 ozs.
Ammonium phosphate, 4 ozs.
Platinum chloride, 1 oz.

Temp. 180 deg. F. Voltage 10 to 12 which will drop to 6 at the plating tank.

To prepare the solution, dissolve the sodium phosphate in ½ gallon distilled water at 180 deg. F. In one pint of similar water, dissolve the platinum chloride then add the ammonium phosphate. Heat the solution for a time at a low boil until the odor of ammonia disappears. Add water to replace the evaporation.

Finally mix thoroughly with the sodium phosphate solution, and then add the balance of 3 pints of water to make up the 1 gallon. Use platinum anodes.—C. H. Proctor.

Progress of the Electro-Plating Industry

A Review of the Progress in 1925 and Prospects for 1926

Written for The Metal Industry by CHARLES H. PROCTOR, Plating-Chemical Editor

CHARLES H. PROCTOR

As I write this review in the closing days of December, 1925, I am glad to note that the business predictions for the country as a whole in last year's review of the electro-plating industry were very close to the actual results. Business in all lines of manufacture has been excellent for the year 1925, although somewhat erratic at times, especially in the automobile and accessory lines, which created a pessimistic feeling through July and August. But in the closing days of the year, a splendidly optimistic feeling is displayed which augurs well for 1926. Many of the great automobile plants will not close down for their usual inventory in January but will continue production to meet the ever increasing demands for automobile products in 1926. After periodic visits to the Middle West I am satisfied that business in all lines of manufacture will be as good as that of automobiles in 1926.

PLATING INDUSTRY DEVELOPING

Unusual prosperity has attended the plating industry in 1925, and remarkable advances have been made in the chemical, electrical and mechanical control of the industry. Closer attention is being paid to standardization and chemical control of plating solutions, which has resulted in much better plated products at no increase in cost to the consumer. This augurs well for the future of the industry and puts it upon a higher plane as compared with a few years ago. It is now a common expression to hear in the plating industry of how much metal is deposited per square foot of surface area; how long the metal will resist corrosion or the influence of the salt spray test; if the basic metal is iron or steel; if of the non-ferrous metals, then the wearing qualities, whether it be of platinum, gold, silver, nickel, copper, bronze or brass. There seems to be a new spirit in manufacture, to produce better products and this spirit has found its way into the plating industry. Great mechanical plating units have been installed in many manufacturing plants and more of such units are about to be installed, especially in the Middle West. These units are well controlled mechanically, electrically and chemically.

In one large plant I saw thirteen hundred and fifty Ford automobile car rims, made of steel, plated in one hour. The rims after fabricating, were cleansed, washed, acid pickled, washed and zinc plated, washed and dried, and at the end of the unit were ready for inspection. Every one of the rims would withstand a minimum of 80 hours under the 20 per cent salt spray test, and such a guaranteed product, costs less than one half of a similarly plated, unguaranteed product of a few years ago.

HARDWARE

There has been but little change in plated finishes in the hardware trades during 1925. In solid metal goods, bronze and brass still predominate. Many finishes of the antique variety are applied to these metals, even silver and gold according to the whims of the consumer. Steel still continues to play a great and important part in the hardware trade. It is the strength and cheapness of the steel that are the important factors and makes it desirable for builders' hardware.

There is an endless variety of finishes applied. These cover natural metal finishes as well as antique. In the automobile trade, nickel still continues to be the king of metals and its use is constantly increasing. No metal finish is as satisfactory to the consumer as nickel when properly applied. Interior automobile hardware is mostly finished in brush nickel and platinum gray. So far silver and gold and antique finishes have not become standard in interior hardware fittings. There are great possibilities, however, in such finishes from the artistic standpoint to match the various cloths, velours and plushes now used in automobile closed car decorations.

In the Sterling silver and silver plate industries, the Sheffield plate and Butler finishes still prevail. Very little bright or burnished goods are in demand. Old Dutch silver with its rich black backgrounds is still in great demand. Bright gold and antique gold finishes are coming back into popular favor.

JEWELRY

In the jewelry industry, platinum is still the metal of intrinsic value and par excellence for those who can invest in such articles of adornment. When I remember about thirty years ago, platinum was worth about ten dollars per ounce, and no one ever considered that the gray metal had any beauty for personal adornment, I realize that times have changed in three decades. I often wonder why palladium has not come into fashion. The color of palladium is more interesting than platinum. It is whiter and is practically as resistant to oxidation as the more expensive platinum. One firm which specializes in white gold watch cases of the wrist-watch type has been trying out palladium, to replace platinum. The results so far have been splendid, and the palladium plated cases seem just as resistant as platinum to the atmosphere.

Green gold is still in greater demand than the usual yellow or karat gold alloys. It is possible to produce any of the standard karat alloys in green gold due to the fact that cadmium, an exceedingly white and non-oxidizable metal, alloys perfectly with gold and produces excellent malleable alloys of green gold in 10, 14 and 18 karat. Beautiful examples of hard vitreous colored enamels are to be seen in the shop, applied to green, yellow and white gold articles of adornment. These articles are both American and foreign manufacture and are greatly admired and in good demand.

LIGHTING FIXTURES

In the lighting fixtures and novelty industries, the

finishes are in endless variety. All the antique finishes of the ancients and of many that never existed until moderns produced them, are still in vogue.

Polychrome with its endless variety of colors is still in great demand. Silver and gold finishes are increasing.

LACQUERS

The lacquer industry is still in a healthy condition. The demand for lacquers is ever increasing in all lines of the metal and furniture industry and many new firms are entering the field. The adoption by the automobile industry of the celluloid enamel finishes has been an important addition to the lacquer industry demands during the past year, when its volume is considered. It is now being used on all types of automobiles, buses, etc., and has proved to be more enduring as a finish than paints and varnishes. Especially is this true in the furniture trade.

PATENTS

During 1925 there were many patents issued to the metal industry covering mechanical apparatus and metal deposits and solutions. There were several patents covering the deposition of chromium, cadmium and alloys of cadmium zinc and mercury. Chromium with its great possibilities as a hard, non-tarnishing metal factor for many base oxidizable metals, is still of great interest to the metal fabricating industry, but apparently it is not yet wholly out of the laboratory stage. I know of only one industrial firm which claims to be depositing chromium commercially, for its own purposes. This is an automobile plant in Lansing, Mich. The solution was developed by the plater of this firm and apparently is a chrome steel alloy deposit.

Cadmium is coming rapidly into favor as a protective factor for iron and steel products, especially in the electrical trades, for nuts and bolts, screws, etc., where the maximum of atmospheric resistance is desired with the minimum amount of metal deposited to avoid the recutting of threads. Unfortunately, cadmium does not exist as a metal in nature. It is always combined with zinc ores and must be separated during the refining process of the zinc. Also unfortunately, as the demand increases, so does its cost. Among patents recently granted were four covering cadmium-mercury alloys and cadmium-zinc-mercury alloys.

In closing this review when all the factors are considered, the year 1925 has marked a great progress in the electro-plating industry. The American Electro-Platers' Society's work is of great value to its membership and to the commercial industry. The membership has greatly increased during the year. Every plater in the United States and Canada should become a member if he wants to increase his knowledge of plating and be of more value to his employers. The work accomplished by the electro deposition section of the American Electrochemical Society, although highly technical, instead of having more actual practice combined with the papers presented at its sessions, still has accomplished considerable for the plating industry.

The National Bureau of Standards, through the able direction of Dr. Burgess, Dr. Blum, Mr. Thomas and Mr. Haring, has been of great value to the electro-plating industry and the American Electro-Platers' Society, due to close co-operation of the Bureau staff and the Research Committee of the American Electro-Platers' Society, and the future should show even greater progress. I am still in favor of the American Electro-Platers' Society carrying on its own research work, but for the time being, owing to lack of finances, the society cannot undertake this work. So I am going to make a plea to every manufacturer in the United States and Canada who maintains a plating department, to subscribe fifty dollars or more to the fund being created by the American Electro-Platers' Society, to maintain a man constantly at the Bureau of Standards to do research work there that will benefit the entire plating industry. The Bureau of Standards has splendid facilities for doing this work. How may will subscribe?

Plating Palladium

Q.—Can palladium be electro-deposited successfully and if so, will you kindly furnish us with any information you can relative to the solution and process, or is there another solution that would be non-tarnishable and give the same white appearance.

Nickel plating is not white enough and we have tried tin plating but this turns dark after exposure.

We wish to use this plating on gold and silver jewelry and the cost is no object.

A.—Palladium is a non-tarnishable metal and is practically free from atmospheric oxidation. In color it closely resembles silver and costs less than half the price of platinum. It has been deposited successfully from the phosphate of soda solution.

The following solution gives good results. It will be found on page 540 of Langbein's Electro Deposition of Metals.

Water, 2 quarts.
Chloride of palladium, 5½ drachms
Phosphate of ammonia, 3½ ozs.
Phosphate of soda, 17½ ozs.
Benzoic acid, 2¾ drachms

The solution should be prepared by dissolving the palladium in one-third the wtaer at 140° F., then add the phosphate of ammonia in the balance of water at the same temperature. Dissolve the phosphate of soda, then add to the palladium and ammonia solution. Operate at 6 volts upward, at 180° F. with palladium anodes.—C. H. PROCTOR.

Plating and Polishing Costs

Q.—Under separate cover we are sending you a cast iron bracket which has been polished on one edge, brass plated and lacquered. We would like to have you tell us what a reasonable price would be for polishing and brass plating these castings in lots of 500 pieces; also the cost of polishing and nickel plating in lots of 500 pieces.

In your opinion do you believe that it would justify us to put in a brass plating and nickel plating plant for forty or fifty thousand of these brackets per year?

A.—While it is difficult for us to give you an exact cost of polishing and plating the gray iron brackets, as per sample, due to the fact that we do not know the wages received by metal polishers in your section, the cost of polishing and plating either in nickel or brass for labor, should not exceed $5.00 per 100. The labor cost should be doubled in order to take care of materials used in polishing and plating and for power, etc.

Depreciation and other incidentals should be figured upon a basis of 15 to 25 per cent. The total cost then, with a profit on labor and equipment per bracket, would be from 11½ to 12½ cents. These figures are maximum. The equipment for polishing and plating would cost somewhere near $2,000.

You might be able to take in some job plating just as long as you have the necessary facilities. The returns would lower your cost considerably and keep your men busy. It would require 2 men to handle your work. The greater part of the year the plater could handle twice as much work as the polisher.—C. H. PROCTOR.

Progress of Metals in 1925—Outlook for 1926

Various Metals Discussed by Leading Authorities

Copper

By R. L. AGASSIZ

President, Copper & Brass Research Association in a Statement to the Associated Press

If copper shipments in December prove anywhere near the average maintained during the first 11 months of the year, 1925 will have shown new high levels in copper consumption, both here and abroad. Unfortunately actual figures for December will not be available until well into January, but we know enough to predict with reasonable certainty that shipments of American copper during the year will be upward of 2,800,000,000 pounds, which is 200,000,000 pounds more than in 1924, the best year since the war.

This has been accomplished in the face of a foreign demand which has been steadily falling off since July because of disturbed economic conditions throughout Europe. Europe is unquestionably the weak spot in the situation at the moment, but we know that the need of copper abroad is very great and feel that as soon as working capital is more available, particularly in Germany, the foreign situation will improve.

Among the new and increased markets for copper are the following: washing machines which now take 15,000,000 pounds of copper per year; range boilers which increased 50 per cent over 1924; iceless refrigeration units, 30,000,000 lbs.

America is, of course, the backbone of the American copper industry and some idea of the increased popularity of copper and copper alloys at home may be gained from the fact that in November, despite the falling off in European demand, shipments exceeded production by nearly 10,000,000 pounds. It is also well worth noting that at the end of November stocks of refined copper available totaled 136,000,000 pounds, although consumption during that month was 237,000,000 pounds. This simply means that gauged by average monthly consumption during the first eleven months of 1925 we entered the last month of the year with less than three weeks supply of refined copper available.

In the circumstances I feel that we have every right to look hopefully towards 1926.

Zinc

Written for The Metal Industry by STEPHEN S. TUTHILL, secretary, American Zinc Institute, Incorporated

Prosperity at home and foreign shortages have made 1925 the banner peace time year of the American zinc industry.

As approximately 45 per cent of the slab zinc produced in this country is used in galvanizing or zinc coating, it is very natural that the members of the American Zinc Institute should be deeply interested in the fortunes of this allied industry. It is estimated that about one-half of the zinc employed in galvanizing goes into the coating of sheets.

One of the marked advances in the galvanizing trade during the year was a determination to mark "seconds" as such, which will present certain dealers mixing "firsts" and "seconds" and selling them as "firsts."

Contrary to a prevailing impression, the zinc industry, as represented by its Institute, is in agreement with the galvanizers in that it does not advocate a heavier zinc coating than is mechanically practicable for the purpose for which it is intended. Neither does the zinc industry favor a price for its product that will approach a "cut-off point" in its use.

One of the difficulties of the galvanizing industry is in not knowing for what purposes its zinc coated products are ultimately to be used. Without such knowledge, naturally no guarantee can be given for a weight of zinc coating not within safe fabricating limits. Or, as some zinc men believe, it may become necessary to manufacture at least two classes of zinc coated sheets; one that can be fabricated without damage and one that is not intended to be fabricated. With two such classes, it would, of course, be necessary to educate the sheet metal workers in this matter, but with the machinery already devised for the promotion of the sale of sheet steel products such instruction could be quickly imparted to the consuming trade.

As is well known, what constitutes proper and adequate zinc coating of iron and sheet steel has been under consideration for some time by Committee A-5 of the American Society for Testing Materials; in fact, its provisional standards on proper weight of zinc coating contemplates, or at least provides for, just such a situation.

Instead of specifying only a single standard weight of coating for a specific gage, the Committee has divided the hot dipped sheets into three classes. Then again, instead of having a standard weight of zinc coating for all gages, this is varied according to the weight of the sheet.

These specifications cover hot dipped Bessemer steel, open-hearth steel, open-hearth iron and wrought-iron sheets in the three classes, as follows:

Class A,—flat or corrugated sheets that are not intended to be formed. (Gages 8 to 22, 2½-oz. per sq. ft.)

Class B,—flat or corrugated sheets to be curved to a large radius. (Gages 8 to 30, 2-oz. to 1.40-oz. per sq. ft.)

Class C,—flat sheets for miscellaneous purposes. (Gages 8 to 30, 1.75-oz. to 1.10-oz. per sq. ft.)

In the opinion of the officials of the American Zinc Institute, the galvanizing industry is as intent as they are in finding a practical way to cover both the fabricating and the non-fabricating requirements of the galvanizing industry, thus restoring and increasing the market for the best of all materials for protecting iron and steel against corrosion, zinc.

It may not be amiss in passing to say that individual galvanizers are more and more turning to the words "zinc coated." The Institute fully appreciates that sales literature must convey its idea to the reader with the least possible mental effort. Nevertheless, a detached view of the present situation in the galvanizing industry is that this is an opportune time to rename a product whose past fully warrants a rechristening. Sheet steel, unprotected,

soon resolves itself into its elements, but, when properly "zinced" or "zinc coated," it takes on a prolonged life that merits the recognition of the material that adds to its days of usefulness.

Another channel into which zinc naturally flows is that of brass making. This is consuming about 33 per cent of the present day output of slab zinc, and as the use of manufactured brass grows so will that of zinc.

The sheet zinc branch of the industry, which is steadily expanding, is consuming about 11 per cent of our slab zinc production.

The remainder, or 11 per cent, includes slab zinc used for the manufacture of French oxide, lithopone, atomized zinc dust, die castings, slush castings and for the desilverization of lead. The greatest growth in these uses of slab zinc will naturally be in the direction of oxide and lithopone.

An interesting feature in the zinc industry is the growth of the high grade zinc output, which rose from 252 tons in 1915 to approximately 78,000 tons in 1924. That tonnage will be exceeded in 1925, and 1926 promises even greater growth, as the Anaconda Copper Mining Company is increasing its annual high grade zinc output from 90,000 tons to 120,000 tons.

Only now and then is the word "spelter" seen or heard. Scientists are prone to cling to this confusing word, holding that, as Prime Western zinc is, technically, an alloy, it should have a special name. Commercially, however, the use of the word "zinc" and the words "slab zinc" have become indelibly fixed in the public mind. Even Canada and Australia are following the United States in this matter. If Prime Western zinc is an alloy, what is a gold ring, containing far more in the way of other components than Prime Western (98 per cent) zinc? The adoption of the word "zinc" and the words "slab zinc" has probably done more to make zinc better known and more widely used than any other thing that has been done by the American Zinc Institute. Its Secretary firmly maintains that, if copper is copper and tin is tin, zinc is zinc. A few points more or less of foreign substances cannot and will not be allowed to stand in the way of the promotion of the American zinc industry.

Lead and Tin

Written for The Metal Industry by O. C. HARN, National Lead Company

LEAD

Nothing particularly noteworthy has happened in the way of new uses of lead for the year. . Of some interest is the announcement by the Bureau of Standards that lead filings had been found superior for making tight pipe joints. The filings are described as made with a coarse rasp and held in place by the cutting oil used in threading the pipe. Lead filing joints withstood a pressure of 8,500 pounds without leaking, whereas half of the joints tested with the other materials showed leaks at that pressure. It was also found that the joints made with the lead filings could be unscrewed much more readily. Of considerably more importance commercially, perhaps, is the announcement at the summer meeting of the American Chemical Society, by R. S. Dean,* of the Western Electric Company, that the hardness of antimonial lead had been considerably increased by heat treatment. The alloy contained between 2 and 3 per cent antimony and, by heating and quenching, the hardness had been increased three times.

During the year announcement has been made from American sources that certain lead salts gave promise of being a cure for cancer. Similar statements were made by British scientists a couple of years ago. The greatest development is the increasing use of lead and lead oxides in the electrical industries.

TIN

Nothing new has been reported during the year in the way of new uses of the metal but there has been considerable interest in familiar uses and there has been satisfactory expansion and demand. No difficulties have developed or are expected with the sources of supply of either lead or tin.

* See THE METAL INDUSTRY for September, 1925, page 393 and October, 1925, page 404.

Aluminum

Written for The Metal Industry by ALUMINUM MAN

Business conditions for the year 1925 have borne out our prediction that the manufacturers of aluminum and aluminum products would be reasonably busy throughout that year. The following resumé indicates the lines of activities which will cover either the bulk of the product for the year 1926 or which give promise of important future developments.

Aluminum bronze powder has been meeting with constantly increasing use. While it has found special favor in the oil industry for oil storage tanks and the conservation of the contents, it has also proved its merits, both for general exterior steel work and interior shop paint. The reflective property of the paint is coupled with remarkable protection properties as is illustrated when it is used upon wood as a preservative, preventing the absorption of water.

Aluminum foil has been used in a constantly increasing quantity, especially since it is now being produced in the United States as thin as .00025 inches thick. It is reported that this thin foil gives an added softness, making it particularly suitable for electrical condensers for which it had not previously been available. Foil somewhat thicker, namely .00035 and .0004 is widely used in the chocolate industry.

The strong alloys are finding an increasing application as is illustrated by some of the industrial applications which have made definite progress in the past year. The rayon industry (artificial silk) uses strong alloys in various places, as, for example, in the stretcher bars, bobbins, spinning boxes, etc.

Automobile bus bodies use strong alloys for structural shapes and other parts where strength and lightness are necessary. The rubber industry uses the strong alloy tubing for inner tube mandrels. The advent of the bal-

loon tire has made the light-weight strong aluminum alloy mandrels especially advantageous.

An entirely new field into which aluminum has made its entry this year is metal furniture. One railway company has placed an order for aluminum chairs for its dining cars. The developments in the design of this furniture give promise of important future developments.

Aluminum alloy airplane propellers are now standard equipment and it is recognized by all aircraft manufacturers that aluminum propellers enable greater speed to be developed than any other kind of propeller which is at present available.

The radio industry has, as formerly, consumed large quantities of aluminum for condensers and other parts. An interesting exhibit at a recent radio show was an all-aluminum radio receiving set where all metal parts were made of aluminum.

The production of aluminum electrical conductors during the year has been very large, giving convincing proof that aluminum has a firmly established place in the electrical transmission field. In fact it is not too much to say that they are fully as popular as copper in their field.

In our review of last year, we spoke of articles produced from aluminum alloys on automatic screw machines. These parts have continued their popularity and their use has increased in quantity and variety.

Aluminum cooking utensils have had only a fair year but undoubtedly more stable throughout than the year 1923.

Another field in which aluminum has proven its usefulness, which was not mentioned in our review of a year ago, is the utilization of aluminum in washing machines. There are several companies using aluminum for various parts of their machines as, for example, the tube, the rotating drum and the wringer. The experience in this use over several years has shown that aluminum can be and is being successfully used for household laundry equipment.

The automobile still consumes a large, and perhaps the largest quantity of aluminum in the form of castings, pistons, connecting rods and bodies.

The collapsible tube, while a very slow development, has made progress during the year 1925. The one company producing collapsible tubes in the United States reports that large orders have been received during the year with a good prospect for the future.

Another entirely new and experimental development is the use of aluminum sheet for roofing shingles. Several roofs have been erected in different parts of the country, using specially designed shingles and from past experience, it is expected that these shingles have a promising future.

For the year 1926, the business outlook at the present time leads us to predict continuance of business conditions that have existed during the year 1925.

Nickel

No statement of nickel progress is obtainable at this time from the chief producer, but from other sources it was learned that nickel production in 1925 exceeded that of 1913 in spite of the almost complete disappearance of war and naval demands. Due to extensive research, many new outlets and markets have been developed for nickel. Technical advances necessarily led the way, among them being improved electro-plating, new alloys, the increased use of nickel in brass foundries as a densifier and toughener, etc.

Another most important field of progress has been the steady growth of the rolled products business, developed by the nickel rolling mill of the International Nickel Company in Huntington, W. Va. This mill is the first in the United States to roll nickel, and Monel metal. Formerly rolled nickel had to be imported.

Proposed War Memorial in the Everlasting Metals

A year ago THE METAL INDUSTRY mentioned what a heavy tonnage of the everlasting rustless metals would be used in the construction of the new Cathedral of St. John the Divine, now being built in New York City, and the new year brings forth the news of a proposed War Memorial in the everlasting metals—a peal of bells which are to be larger and better than any ever cast.

August Heckscher, a wealthy New York citizen and civic philanthropist has offered to give to the City of New York, a carillon (which is an improved set of chimes) and the memorial is to include a great bell which is to be the largest and best ever turned out in a bell foundry, and which is to be tolled only on Armistice Day, as a permanent memorial to the heroic dead of the World War.

The idea of such a war memorial was presented by Heathcote M. Woolsey, an architect, in the columns of the New York Herald-Tribune in December 1924, and now that a wealthy New Yorker is interested in the project, it may be carried to completion. While the details of the bell tower have not been perfected, a comparison of other famous bell castings, indicates the quantity of metal required in the founding, the mixture for bell metal being copper 75-80 per cent and tin 20-25 per cent.

Heretofore, the largest and heaviest single bell, and what is claimed to be the largest metal casting ever made in the world, is the great bell in Moscow, cast in 1734 and weighing nearly 440,000 pounds. The Moscow bell is of course, one of the world's remarkable castings, and while never exceeded in size by a single bell casting, it has smaller contemporaries in European cities and on other continents.

A comparison of a modern bell installation is the carillon given by John D. Rockefeller, Jr., to the Park Avenue Church in New York, which includes 53 bells with a total weight of metal of 110,199 pounds.

Comparing the above figures with the proposed bell memorial, the amount of metal that the tower will take, will be over four hundred thousand pounds and will require the most exacting practice and skill of the bell founder's art.

If the bell memorial is built, this splendid piece of workmanship in the everlasting metals, will fall to the lot of some master caster and chime tuner. And with the ringing of the big bell and the chimes, the populace can imagine the spirit of the Marching Hosts, expressed in the words of the poet Poe.

"Keeping time, time, time
In a sort of Runic rhyme
To the paean of the bells."

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With Which Are Incorporated

THE ALUMINUM WORLD, COPPER and BRASS, THE BRASS FOUNDER and FINISHER
THE ELECTRO-PLATERS' REVIEW

Member of Audit Bureau of Circulations and The Associated Business Papers

Entered February 10, 1903, at New York, N. Y., as second class matter under Act of Congress March 3, 1879

SUBSCRIPTION PRICE, United States and Canada $1.00 Per Year. Other Countries $2.00 Per Year : : SINGLE COPIES, 10 CENTS
Please Remit by Check or Money Order; Cash Should Be Registered

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ADDRESS ALL CORRESPONDENCE TO
THE METAL INDUSTRY, 99 JOHN STREET, NEW YORK
Telephone Number: Beekman 0404. Cable Address: Metalustry

Vol. 24 New York, January, 1926 No. 1

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EDITORIAL

Review of The Metal Industries for 1925—Outlook for 1926

The year 1925 was a good year. From the point of view of the world at large, it was a year of approaching sanity and stabilization. The nations decided that peace was the best policy and bent every effort in that direction American industry as a whole had one of its most prosperous periods beginning almost immediately after the Presidential Election. The revival of business, led by an unprecedented feeling of optimism, continued steadily throughout the whole year. This applied particularly to some of the largest consumers of metal products with the result that rolling mills, foundries and plating plants were kept going at almost full capacity.

The automobile industry had a tremendous year. Railroads, although their buying did not equal that of 1924, nevertheless spent large sums and had a most profitable period; which augurs well for 1926. The electrical industries went ahead steadily, showing an unwavering increase in their usual solid fashion. These industries continue to be the backbone of the metal consumers. Agriculture held up quite well after a sharp decline from the first boom prices, holding to figures approximately 50 to 70 per cent above pre-war, and this condition was, of course, immediately reflected in the manufacturing industries since there can be no general prosperity without a healthy condition in agriculture.

An interesting feature of the business during the last year, which leads one to think that it was not merely inflated, is shown by two facts.

1. Unfilled orders did not go out of bounds. In other words, purchasers did not lose their heads and place large orders far ahead. At no time did manufacturers have an inordinate quantity of forward orders on their books. 2. The margin of profit was essentially low. In many cases this caused complaint, operators stating that they were keeping their plants running at top speed but without showing a profit. While this was undoubtedly the case in many instances and the margin was certainly less than in 1919 and 1920, nevertheless, as a whole there has been a profit, more or less reasonable as the case may have been. Purchasers have been careful and there has been no runaway market.

METALS IN 1925

As a whole the course of the various metals in 1925 was steady, but rising. Copper fluctuated between 13½ and 15. Zinc starting at about 8 and falling off badly during the middle of the year, has risen again, closing at about 9. Tin, in spite of its usual gyrations, is closing well over 60. Lead has been consistently good, starting at 10, never going below about 8, and finishing about 9. Aluminum, of course closely controlled, has been steady. The price has been held at 28 all year until October, when it was made 29. Nickel has also been held steady by the largest producer, selling at 38. Antimony has undergone wide fluctuations, starting at 17 going up to 20, back to 12½ and closing at about 22. Silver, another fantastic performer started at about 68, dropped shortly afterward to 58, but rose as quickly and has since then held up well between 67 and 72, closing at about 69. Platinum moved narrowly between 117 and 120.

TECHNICAL PROGRESS

Along technical lines, the year has been decidedly interesting and some of the new developments have been of a nature to cause far-reaching changes in the industry in the future.

AMERICAN FOUNDRYMEN'S ASSOCIATION

The convention of the American Foundrymen's Association and the Institute of Metals Division, showed a commendable tendency of these organizations to concentrate on definite concrete problems. Special sessions were held on brass, aluminum, refractories, sand control, costs, etc. Committees have been appointed to devote themselves exclusively to specific subjects such as the Committee on Non-Ferrous Metals, headed by Jesse L. Jones. A symposium is being organized on permanent and long-life mold casting; also under the direction of Mr. Jones. The Round Table on brass foundry topics brought out some of the basic problems in the foundry industry, among which were: flasks in the brass foundry; pyrometers; furnace atmospheres; nickel in brass. Special committees are actively at work on both old and new problems, including foundry sands, refractories, foundry costs and specifications on standards relating to the foundry industry.

NEW EQUIPMENT

An interesting piece of foundry equipment is the improved Ajax-Northrup electric furnace, designed for brass foundry use, this furnace being exhibited at the Syracuse convention. Another exhibit worth noting was the Wood process molding machine in which both cope and drag flasks are permanently attached to the machine. No flasks are used but only pouring jackets.

In rolling mill equipment, a device of unusual interest was developed by the Snead Company, and described in an article by Chas. C. Waite, chief engineer of that company, in THE METAL INDUSTRY for November, 1925, on an electric heat treating and annealing device which anneals tube, rod, strip, etc., automatically and by the direct use of the electric current. This annealing machine promises to be a very important factor in brass rolling mill operations.

Another feature of growing importance has been the increased use of glazed and carborundum crucibles for brass melting. Some extraordinary records have been made, some crucibles having run over 200 heats.

INSTITUTE OF METALS

At the February, 1925 meeting of the Institute of Metals Division, two new types of high strength aluminum alloys were described by Archer and Jeffries, one being of the aluminum-copper type containing about 4 per cent copper, .35 per cent iron and .21 per cent silicon. The other was of the aluminum-magnesium-silicon type. One alloy contained 1 per cent magnesium and .6 per cent silicon. It was pointed out that both of these types possessed decidedly better working qualities than Duralumin. Bassett and Davis reported on a ten-year sea water corrosion test of tubes of several copper alloys, which showed a good correlation with a one-year salt spray test on sheet metal specimens of the same composition.

BUREAU OF MINES

The Bureau of Mines is working on the possible development of new uses for silver and a large number of silver alloys have been examined. A dozen alloys, chiefly those based on zinc or cadmium, as the main alloying element, can be made of Sterling fineness, are workable, have a satisfactory appearance and properties, and are decidedly more resistant to tarnish than ordinary Sterling silver. The Bureau is also studying the problem of preventing or decreasing the enormous financial losses caused every year by the corrosion of oil field equipment. This is essentially a metallurgical problem and will probably be solved by the specification of the correct alloys or the correct means of metal protection.

STANDARDIZATION

The increase in industrial standardization has gone on steadily. In August, 1925, the Department of Commerce issued a Directory of Specifications listing approximately 27,000 existing specifications for 6,000 commodities. This Directory will some day be considered indispensable in connection with purchases. Moreover it shows the extraordinary multiplicity of specifications on the same object and the consequent need for simplification.

One of the major problems of engineering and metallurgy, which is perhaps becoming more and more complicated, is the question of selecting the best metal or alloy for a given purpose. It has been estimated that more than 5,000 metals and alloys of different chemical composition are in use and in many instances the same compositions have various qualities depending upon whether they are used in the form of castings or in the worked condition. In the worked condition a variety of physical properties can be obtained. The complexity of the problem is obvious and although in some cases, the choice is simple, in others it is infinitely involved. As stated by Dr. Jeffries, in most cases the selection is made by "economic compromise", that is to choose the material which will satisfy best the question of suitability in service and economy in cost. For example, although steel is of course cheaper than brass, yet the superior working qualities of brass and the consequently greater output per machine may in many cases result in lower costs by the use of the more expensive material. More and more the question of the correct specification of materials, particularly metals, because of the large variety of choices, is becoming one of the most important functions in engineering and manufacturing. For that reason among others, specifications as they appear from the various sources should be watched more closely than ever.

One of the important sources of these specifications is the American Society for Testing Materials, an organization functioning to aid the producer so that he will have standards to which to work, and the consumer so that he will know how to judge his purchases. One of the new projects being taken up is that of the effect of various temperatures on the properties of metals.

ELECTRO-PLATING RESEARCH

The American Electro-Platers' Society has, in addition to its regular program, taken a great step by joining the Bureau of Standards in promoting the increased research work of that Bureau along the lines of electro-deposition. The plan is to get 200 manufacturers to contribute $50 each for three years, the funds to be held in trust by the American Electro-Platers' Society and to be expended only for salaries and expenses of the persons engaged in this work at the Bureau. The importance of this project cannot be overestimated.

Another advance in electro-plating is the increased use of the pH method of controlling the acidity of the nickel bath. Cadmium plating has increased in its scope; zinc plating has also been improved considerably. And last, but certainly not least, chromium plating has absorbed a considerable part of the attention of the electro-plating and metal manufacturing industries. Electroplaters and electrochemists have massed their attack on the problem of corrosion by developing improved protective coatings for metals and it is safe to say that their share in the solution of this problem will be large.

A new technical society has been founded for work on electro-deposition, namely the Electro-Platers and Depositers Technical Society, with headquarters at the Faraday Society in London, England. The first meeting was held during November in which the objects, scope, meetings, etc., were discussed and planned. Americans interested in this work wish their new co-workers every success.

ECONOMIC DEVELOPMENTS IN METALS

In this issue is a symposium on the events of interest during the last year in the fields of the various base metals. Briefly, they can be summarized as follows. Copper has continued to make great strides in finding new domestic outlets for its increased production. At the present time, the United States consumes about 70 per cent of its output. It remains only for the producers to use sound judgment in regulating the supply of copper to the demand, avoiding excessive shortages, and consequently inordinately high prices, just as carefully as they would overproduction.

Aluminum continues to branch out even more rapidly. According to Dr. Anderson, in Mineral Industry, the American aluminum output was approximately 93,000 metric tons in 1924, about 50 per cent of the world's production in that year. It is estimated that there has been a regular increase in the consumption of aluminum of about 100 per cent every five years since 1900. The distribution of aluminum is estimated roughly as follows. Automobiles 50 per cent or about 100,000,000 pounds; electrical industries 10 per cent; general engineering trades 15 per cent; steel industry 5 per cent; cooking utensils 10 per cent; miscellaneous purposes, such as aircraft, chemical plant equipment, paint industry, 10 per cent.

The tendency in the automobile industry is to decrease prices in order to facilitate the enormous distribution which this industry has attained. As a result, aluminum, being a relatively high priced raw material, compared with steel is being eliminated wherever possible in the lower priced cars. This is a matter of no small moment, and although it has made no great difference as yet in the output of aluminum, nevertheless, it has forced producers to look for as many new outlets as possible.

Lead and tin have shown no unusual developments but have been increasingly and steadily in demand for standard uses.

Zinc, although it has found no new uses to any great extent, is concentrating on the problem of improved quality particularly in zinc coating. It has become a fixed principle with the zinc producers that the zinc-coated or galvanized sheets should have enough zinc on them to form an adequate coating. "Skimping" is now in bad odor and quality is stressed.

The platinum situation is practically unchanged, and the only hope for industry is either new sources or substitutes. So long as jewelry continues to demand platinum, particularly because of its high price, so long will industrial uses be held down. An item which is very interesting, if true, was published recently in the daily press, telling about the discovery of a "reef" of platinum ore in South Africa, 200 miles long and 60 miles wide. It is our sincere wish that this may prove to be the case, and the deposit, commercially workable. Another item mentions that tantalum can be substituted for platinum in many ways in industry. Both the above statements are necessarily far from commercial realization, but they show

the general trend of thought. Sooner or later platinum must be either cheapened or eliminated, so far as industry is concerned.

DEPARTMENT OF COMMERCE WORK

Other economic features of great importance to metals as well as to other industries can be cited at length but two outstanding factors are those sponsored by the Department of Commerce under Secretary Hoover. The first is the continued elimination of excess sizes, types, styles, etc., and the consequent simplification of manufactures. So much has been said on this subject already, both in these columns and others, that it is unnecessary to go into it again at great length. It is generally recognized that this work has been of untold benefit both to industry and to the consuming public, and it is a matter for congratulation that it is going on without a stop.

The other project is that of the intelligent and careful development of trade associations for the purpose of distributing lawful trade statistics and information. Everyone realizes that trade associations have a most important function which they can perform legitimately, and be of value, not only to their members but to consumers. Their purpose is not to eliminate competition but to make it more intelligent and less wasteful. The Chamber of Commerce of the United States is co-operating with the Department of Commerce and the various individual trade associations, to bring about this condition.

METALS IN AIRCRAFT

One of the events of general public interest which affected the metal industries was the building and sailing of the airship, Shenandoah. Last September, it made a special trip to the Middle West and while over Ohio was caught in a storm and destroyed, with great loss of life. According to a Naval Court of Inquiry the wreck of the Shenandoah was caused by "large unbalanced, extensive, aero-dynamic forces rising from great velocity currents". A change in the Shenandoah that resulted from the reduction in a number of her gas valves was declared to have been inadvisable. The findings of the Court were lengthy but simmered down to the statement that whatever faults there may have been were not in design or materials, but in such changes as the one mentioned above. No fault was found with the metals used in her construction and there is no question about the continued use of Duralumin in aircraft.

NECROLOGY

Among the men of prominence in the metal industries who passed away during 1925 were the following:

L. D. Waixel, Newark, N. J., general manager of the Union Smelting and Refining Branch of the Federated Metals Corporation; William D. Hoxie, New York, vice-chairman, Babcock & Willcox Company; James W. Beard, New York, controller, International Nickel Company; Albert F. Rockwell, Bristol, Conn., founder of the New Departure Company, and the Marlin-Rockwell Corporation; Herbert Manton Upson, Waterbury, Conn., assistant treasurer of the Chase Companies, Inc.; Harold W. Pickett, Seymour, Conn., assistant treasurer New Haven Copper Company; A. O. Backert, Cleveland, Ohio, president Penton Publishing Company; Elwood Haynes, Kokomo, Ind., inventor of Stellite; Walter P. French, Philadelphia, Pa., treasurer E. J. Lavino and Company; Arthur Jacob, Hatch End, Middlesex, England, manager British Aluminum Company, Ltd.; George Smart, New York, managing editor The Iron Age; George Westerman, Torrington, Conn., American Brass Company; C. P. Karr, Washington, D. C., Bureau of Standards, a frequent contributor to THE METAL INDUSTRY; John A. Stevens, Brooklyn, N. Y., formerly vice-president National Lead Company, United Lead Company and Matheson Lead Company; C. Upham Ely, New York, president Ely Anode & Supply Company; Edwin T. Peters, Stamford, Conn., Stamford Rolling Mills; Joseph Mitchell, Plainfield, N. J., president John Williams, Inc.; Alexander Mathes, St. Louis, Mo., treasurer General Metals Refining Company; Robert H. Engle, Trenton, N. J., president United Zinc Smelting Corporation; Raimond D. Foster, Newark, N. J., formerly vice-president Hanson & Van Winkle Company; John Francis Bell, Pittsburgh, Pa., Bell Brothers; Dwight L. Somers, Waterbury, Conn., American Brass Company; Walter H. Perkins, Watertown, N. Y., formerly vice-president J. B. Wise Company.

OUTLOOK FOR 1926

The metal industries are essentially secondary in character, that is, they depend upon certain other trades for their prosperity rather than the general public. For that reason the only way of judging the coming year in metals, is to check the opinions of those engaged in the industries which use metals and metal products. In statements made to the associated press, a number of industrial leaders have signified their confidence in prosperity for the coming year. Henry L. Doherty states that the outlook for the petroleum industry is more assuring than at any other previous time in the last four-year period. S. Z. Mitchell, president of the Electric Bond and Share Company sees new records established in the coming year, in electrical industries. The automobile industry is spoken for by Alfred P. Sloane, Jr., president of the General Motors Corporation to the effect that the first half of 1926 should be a period of general prosperity while the second half is still too far away to judge. Carl R. Gray, president of the Union Pacific System feels that prospects of the railroads in his territory are the best in years, and good business for the railroads means large buying of supplies and equipment. P. A. S. Franklin of the International Mercantile Corporation expects the shipping industry to do better in 1926 than it did in 1925.

Probably more questions are being asked about building construction than any one other field, and here the answer is not easy. Public statements have appeared in the press advising operators to be more careful during the coming year. These statements were immediately followed by contradictions, and the answer seems to be that authorities disagree. The Architectural Forum, an authority on building, estimates that 1926 will be another $6,000,000,000 building year, like 1925. If this sounds over-confident, it must be remembered that the Architectural Forum predicted last year that 1925 would be a big building year and events proved them correct, in spite of other opinions to the contrary.

The general atmosphere and broad influences seem to be in the right direction. Conditions abroad are improving, which affects our American banking situation to a degree not always realized by manufacturers who have their eyes fixed on their own immediate problems, with consequently faulty perspective. The Federal government is setting an admirable example by cutting expenditures and taxes in every possible place, and it remains only for state and municipal governments to follow, to give relief not only to business, to provide new capital for expansion and replacements, but also to remove the restraints from the general purchasing power, now imposed upon the large proportion of the people by high cost of individual necessities.

THE METAL INDUSTRY has watched and recorded the progress of the metal industries for twenty-three years, and in entering on our twenty-fourth year we have never seen a time when the coming period looked more soundly and sanely promising.

CORRESPONDENCE and DISCUSSION

Although we cordially invite criticisms and expressions of opinion in these columns, THE METAL INDUSTRY assumes no responsibility for statements made therein

ZIRCONIUM—ALUMINUM ALLOYS

To the Editor of THE METAL INDUSTRY:

It may interest the readers of THE METAL INDUSTRY to know, in view of the numerous aluminum alloys, that have been exploited and given publicity up to the present time, in their wide range of application that I have failed to notice any that contained zirconium and its alloys. I desire to call your attention to this fact for the reason that a few years ago I was doing some missionary work with aluminum alloys and I made one containing 5 per cent of a 75 per cent iron and 25 per cent zirconium alloy (the balance aluminum), that had some wonderful characteristics. Out of an even dozen test bars that were made and pulled there was not a variation of 2 pounds in the lot which had a tensile strength of 3,100 pounds per square inch with an elongation of 18 per cent.

These test bars were cast in iron molds in pairs and were not machined and would have had much higher physical properties, had they been hot or cold forged. A hardener was first made which was added to the melt of aluminum, then poured. None were cast in sand for the reason that sand castings were not made by the concern. Also, in numerous other tests made with this element with larger and smaller percentages in the melt, the physical properties as set forth were not improved.

I feel that these figures can be augmented with an alloy containing zirconium and nickel with a modicum of silicon and iron, and it is worth going after, to those that are looking for high figures in aluminum compositions. Although zinc forms what are known as solid solutions with aluminum, which have been fully studied by various investigators and largely used in the motor industry, there is a bigger field in engineering possibilities for a strong aluminum.

Asbury Park, N. J. EDWARD D. GLEASON.
December 10, 1925.

COLORING BRASS

To the Editor of THE METAL INDUSTRY:

Problem 3,429, Chocolate Brown. If I am not mistaken it should be a French brown. If so a French brown can be made as a dip as follows:

Water	1 gallon
Chlorate of potash	1½ ozs.
Sulphate of copper	1½ ozs.

This will produce an antique bronze color with just a light tint of olive on brass. It has beauty, and is used for fixtures, hardware and art goods. The solution is said to act very quickly. It will work on either polished or brushed surfaces and even on castings. The finish should afterwards be scratch-brushed. On bronze metal a light brown color can be obtained with the same dip. Afterwards they should be lacquered with high grade lacquer.

Problem 3,431. Green on Copper. A green color can be produced as follows:

Water	1 gallon
Perchloride of copper	8 ozs.
Perchloride of iron	8 ozs.

This dip should be used hot; either polished or brush work can be oxidized, but I had better success with the brush work. A slight brown will show. Hence you must scratch-brush them. The green will show.

Coldwater, Mich. ANDREW V. RE.
December 18, 1925.

GIVE CARE TO THE GENERATOR

To the Editor of THE METAL INDUSTRY:

There is in every modern plating room a dynamo, or what is more generally called a generator, that generates the electrical current for plating purpose.

The writer has on various occasions been called on to locate trouble in the plating room, and in a great many instances, has found that if the operator had taken a little time each morning to look after his generator, instead of just starting and expecting the generator to take care of itself, he would find that these few minutes each morning would not only eliminate a great amount of trouble, but the generator would give the service that is required of it.

The writer well knows that all platers are keyed up to the highest pitch at this time to get production, but they should know also, that at the same time, it behooves them to keep their generator as well as other machinery that is in their care, in repair, or production is curtailed, and they have a lot of grief that is unnecessary.

Each of us knows how unpleasant it is to report to the manager that there is something wrong, and that you are stuck, and unable to find the trouble.

So give your generator just a few minutes each morning, and note the results, which will be very pleasant, not only to the plater, but also to the firm of which you are an employee.

Sarnia, Ontario, Canada. FRANK POWERS,
December 15, 1925. Mueller, Limited.

New Books

The Metal Worker's Practical Calculator. By J. Matheson. Published by Isaac Pitman & Sons. Size 5 x 7. 66 pages. Price, payable in advance, 60 cents. For sale by THE METAL INDUSTRY.

A handy little book intended primarily for the man in the work shop. It covers a practical course of applied arithmetic and mensuration. Part 1 outlines the general principles of the arithmetic involved in sheet metal and shop work, and Part 2 gives actual examples of the application of these principles to shop problems.

Metallurgy. By E. L. Rhead. Published by Longmans, Green and Company. Size 5 x 7½, 403 pages. Price, payable in advance, $2.50. For sale by THE METAL INDUSTRY.

This is a new edition of an elementary text-book intended primarily for students and beginners in the metal industries. Considerable additions have been made to the chapters on iron and steel, copper, silver, gold and nickel. The book covers the basic principles of the extraction and working of metals, and makes a good simple reference book, giving an excellent perspective of the subject.

Chapter headings are as follows. Physical Properties of Metals; Metallurgical Terms and Processes; Furnace Types; Refractory Materials; Fuels; Gas Fuel; Iron; Iron Smelting; Chemical Reactions and Products of Blast Furnace; Malleable or Wrought Iron; Steel; Copper; Lead; Mercury; Silver; Gold; Tin; Zinc and Antimony; Nickel and other Metals; Alloys.

GOVERNMENT PUBLICATIONS

Lead in 1925. Department of Commerce, Washington, D. C.

Arsenic in 1925. Department of Commerce, Washington, D. C.

Copper in 1925. Department of Commerce, Washington, D. C.

The Lead Industry. I. North America, South America and Oceania. Prepared by R. M. Santmyers, Bureau of Foreign and Domestic Commerce, with a report on United States Production and Trade, by C. E. Siebenthal, U. S. Geological Survey, Washington, D. C.

SHOP PROBLEMS

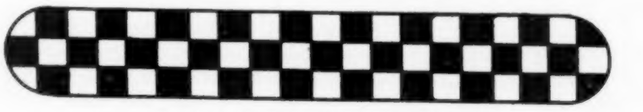
IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE

ASSOCIATE EDITORS { JESSE L. JONES, Metallurgical / WILLIAM J. PETTIS, Rolling Mill — W. J. REARDON, Foundry. CHARLES H. PROCTOR, Plating Chemical / W. L. ABATE, Brass Finishing. P. W. BLAIR, Mechanical

BLACK ON GOLD

Q.—I am receiving some white, green and red gold-filled knife shells, and I would like to know what kind of dead black to use so that the high surface may be rubbed off afterwards.

On the diagram the black spots are the sunken surfaces.



DECORATED KNIFE SHELL

A.—Dead black Jap-a-Lac will answer your purpose admirably. You can purchase this material in any paint store. Paint the background of the shells with the material by the aid of ½ inch flat chisel edge varnish brush. Then let the black finish become partly dry; remove the excess from the high lights with a cloth or piece of felt that is slightly moistened with equal parts of linseed oil and turpentine. You can prepare a black by mixing refined lamp black with Japan dryers, if you wish. The application and removal are the same as for Jap-a-Lac.—C. H. P. Problem. 3,475

BRONZE TABLET BACKGROUND

Q.—We are engaged in the manufacture of statuary bronze tablets. In the past we have been staining the background with colored lacquer for contrast between it and the finished letters and border.

It is desirable to oxidize the background chemically, and if any books will give us the formula, wish you would kindly let us have same. It is desired to oxidize the background to a very dark brown color—almost black.

A.—You can produce the background finish you desire as follows: The plates should be thoroughly cleansed by scouring down with the following cleansing mixture:

Water	1 gal.
Slacked lime	1 lb.
Pumice stone, powdered	1 lb.
Sodium cyanide	4 ozs.

Heat the water to 120 deg. F., dissolve the cyanide first, then add the other materials. A pasty mass should result. If not, add more lime and pumice stone until such a paste results. Scour the tablets down with hand tampico scouring brushes. The operator should wear rubber gloves to protect his hands from the action of the cyanides. After scouring, wash the bronze tablet thoroughly with a hose.

Immerse the tablet in boiling hot water, then remove and drain the excess of water from it.

The following solution should have been previously prepared a day before and held in readiness for use to produce the oxidized finish: Water, 1 gallon; polysulphide, 4 ozs.; aqua ammonia, 26°, 2 ozs.; temperature, 120° F. Keep the liquid in a stoppered bottle when not in use.

Apply the oxidizing solution to the heated bronze tablet with a brush as rapidly as possible. As soon as the background is sufficiently dark, then wash off the excess of oxidizing solution immediately with water. Dry out the tablet by immersing in boiling water. When thoroughly dry, the oxidized surface can be brushed with a steel wire scratch-brush. The details of the high lights can be brought out with emery cloth or sandpaper, or steel wool, and then finally lacquer or wax the entire surface to protect it. Polysulphide can be purchased through advertisers in THE METAL INDUSTRY.—C. H. P. Problem. 3,476

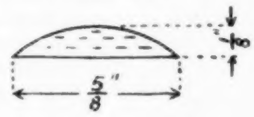
COPPER AND NICKEL ON STEEL STRIPS

Q.—We are required to plate a special steel strip, the cross section of which is shown in Fig. 1. These strips are about 5′ 6″ long, and are used on a wooden auto bumper, so, of course, must have a very durable finish. After we have finished these strips in nickel, they are fastened to the wooden bumper bow, as shown in Fig. 2, necessitating two right angle bends (nearly) at the top and bottom corners of the end of the bow. This is where our problem arises. We find that the nickel peels at A and B, after bending. We have tried the following processes, but still have peeling with which to contend.

1. Acid copper buffed and { a, very light nickel plate, buffed. / b, heavy nickel plate, buffed.
2. Cyanide copper buffed and { a, very light nickel plate, buffed. / b, heavy nickel plate, buffed.
3. Copper strike only and heavy nickel plate.

The nickel solution we are using consists of: water, 1 gallon; nickel chloride, 2 ozs.; sodium chloride, ½ oz.; single nickel salts, 10 ozs.; sal-ammoniac, 1 oz.; Baumé, 8°.

Fig. 1



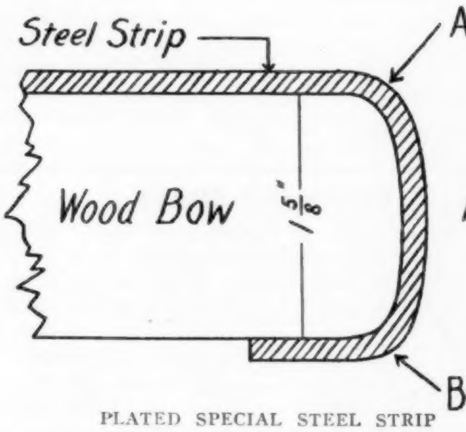


Fig 2

PLATED SPECIAL STEEL STRIP

A.—The formula for nickel solution you are using is a good reliable formula and no doubt plates satisfactorily on brass without any trouble due to peeling.

We are going to make the following suggestions to improve the nickel deposit:

1. After the copper deposit has been polished and cleansed as usual, brush down with powdered lime and water, using the regular platers' hand brush for the purpose. After scouring with the lime, wash thoroughly and plate direct. Note the results.
2. Make the following additions to your nickel solution, per gallon: 10 ozs. single nickel salts; then follow up with 6 ozs. Epsom salts; then add ⅓ oz. 75% acetic acid. The nickel solution should be operated at 80° to 110° F. If possible, arrange a mechanical motion so that the strips are lifted up and down vertically about 5 times per minute. When strips are first put into the nickel solution, lift them up and down twice before making the connection so that any possible adherence of hydrogen will be washed off by the lifting motion.

It is our opinion that your real trouble is due to the hydrogen layer that forms immediately upon the copper-plated strips when first immersed in the nickel solution.

3. As a final resort, if the condition still persists after following out the suggestions we have made, apply the following remedy: In 4 gallons of hot water at 120° F., dissolve 1 lb. of sodium perborate; stir constantly until the material is all dissolved, then add sufficient muriatic acid to the solution until it shows a very

slight acidity to blue litmus paper test, or just below or equal to the acidity of your nickel solution. The amount mentioned will be sufficient for 250 gallons of nickel solution. Add 1 gallon of the solution so prepared to the nickel solution first, then repeat at intervals; stir thoroughly into solution. We feel sure these suggestions will eliminate for all time your trouble of peeled nickel deposits.—C. H. P. Problem. 3,477

ROUGH COPPER DEPOSIT

Q.—I have an acid copper solution and it plates rough. It has been working since July and is made up of: water, 1 gallon; commercial sulphate of copper, 1¾ lbs.; free sulphuric acid, 2 ozs.; alum, 2 ozs. If I run it 1 hour with current enough to plate, it is rough; and if I cut the current, it comes out as if burnt. I do quite a few radiator shells for automobile companies who want a lot of copper on all their work. I have been using a battery-charging generator, but I have ordered a new genator, 1,000 amp., 6 volt. It has a self-exciting field rheostat, compound wound. The copper tank is 72" x 36" x 30". I have two work rods on my copper, sometimes. I plate 2 shells, sometimes 4, and sometimes one is plated on the top side and not on the bottom. How do you account for that? I have 2 hooks as big as a lead pencil. I would like to plate 4 at a time. The roughness is on the top side, and the bottom side is as smooth as glass, but takes 1 to 1½ hours to cover scratches, and they are polished on 150 sheepskin, colored with tampico around the top side. I use a commercial electric cleaner, consisting of caustic soda, muriatic acid and cyanide.

A.—If your copper solution has been giving you good results, since it was made up in July, and recently the copper deposit has become rough under normal current conditions, it means that the formula has changed in composition. In the winter, considerably more free acid can be carried in solution, due to the lowering of the temperature unless the metal content has become much lower. As a remedy, first add ¼ to ½ oz. per gallon of yellow dextrine previously dissolved in hot water. If this addition does not produce a smoother deposit, then it may be necessary to add more free acid. Such an addition can be safely made up to 4 or 6 ozs. per gallon of solution. Make a test with 10 or 20 gallons of solution. To keep up the metal content, copper sulphate should always be suspended in the solution overnight, preferably in burlap bags. In one hour, you should get plenty of copper.

Evidently from your information covering the amount of current at your disposal, you have ample. Six volts, however, are too much for best results in acid copper plating; 2 volts are ample.—C. H. P. Problem. 3,478

SILVER ON VARIOUS METALS

Q.—How much sodium cyanide per gallon ought to be in a silver solution for plating hollow-ware with the work rod continuously moving up and down? What makes the iron rods that the anodes hang on, turn black? In the Langbein and Brannt book (on page 590) about plating aluminum by Professor Nees, it states "to immerse in a solution of 77 troy grains of chloride of mercury." Does that mean per gallon or how much? Can aluminum be plated in this way?

A.—It is difficult to estimate the free cyanide required in a silver plating solution without knowledge of the amount of metal carried in the solution. Free cyanide is, therefore, a conditional factor. It may run from 2 ozs., for a fairly normal solution, say 2 ozs. of metal per gallon, up to 4½ ozs. for 4 ozs. of metal per gallon. Even this amount may be considerably exceeded if the solution is high in carbonates. The free cyanide content of any solution should be as high as possible consistent with a good normal metal deposit. Within defined limits, free cyanide means a greater anode reduction and greater throwing power.

Nickel reduces very slowly in cyanide solutions. A small amount of nickel in the silver solution would do no harm. Why not try nickel anode rods?

You do not mention what metal you wish to deposit upon aluminum. In any event, nickel deposits make the best basis for other metals. We do not advocate the use of mercury for deposit upon aluminum. The method used by many automobile manufacturers is as follows:

1. The aluminum to be polished to the desired surface, then cleansed from polishing material, greases, etc., by usual cleansing methods.

2. Immerse for a moment or two after regular cleansing in a caustic soda or potash solution about 4 ozs. per gallon of water. Temperature 200-212 deg. F.

3. Prepare an acid dip in an acid jar made of regular vitrified stoneware, on the basis of nitric acid 2 gallons; sulphuric acid 1 gallon and perchloride of iron 2 ozs. The acid dip should be used when cold always. Stir the acid dip before using. Immerse the aluminum articles in the acid dip after cleansing as outlined for a moment or two, then remove, wash quickly and thoroughly in water and nickel plate in any good nickel solution. Always use sufficient current to cover over the aluminum surface quickly. Plate as long as necessary for satisfactory deposit. The nickel deposit can then be made the basis for silver or other deposits.—C. H. P. Problem. 3,479

SILVERING MIRRORS

Q.—Will you please give me a formula for silvering mirrors, one that can be used on a small scale? I am plating in a job shop, and have lots of calls for re-silvering mirrors. Will be very thankful for any information you can give me.

A.—A complete description of re-silvering mirrors will be found in an article by C. H. Proctor, entitled Re-Silvering Mirrors, in the May 1923 issue, page 193, of THE METAL INDUSTRY.—C. H. P. Problem. 3,480

SLOW NICKEL SOLUTION

Q.—My nickel plates too slowly. I would like to put on a heavy nickel in abount 30 minutes. My solution consists of double salts, 8 ozs.; water, 1 gallon; salt, 1 oz.; Epsom salts, 2 ozs. I intend to change the double to single. I am troubled with hydrogen gas bubbles, especially on shells before coppering, and I would like to get rid of them. I plate zinc die castings but with lots of current. I have a mechanical agitator. My nickel is over 1100 gallons. They want me to put out work as fast as the Packard motor car does, in my little shop. I will have to make my nickel stronger, won't I? The nickel is beautiful when colored up, but it takes 1 hour to get a good plate.

A.—To increase the rate of deposition of nickel, your present solution will have to be built up with metal. At present it contains only 1.12 ozs. of metal per gallon. Add 1 pound of single nickel salts; 10 ozs. Epsom salts, 3 ozs. boracic acid. Increase the temperature of the solution to 100-110° F. The addition of 16 ozs. single nickel salts will increase the metal content to 4.64 ozs. per gallon and should enable you to produce a satisfactory heavy nickel deposit in 30 minutes, using the maximum current density, and 25 to 50 amperes per sq. ft. of surface area.

You can control hydrogen pitting by using sodium perborate. For 250 gallons of solution, dissolve 1 pound in 4 gallons warm water; stir thoroughly until all dissolved, and the solution becomes clear. Add muriatic acid in small proportions to the sodium perborate solution until it becomes a little less acid than your nickel solution. It may require 16 fluid ozs. to produce such results. Stir the solution so prepared very thoroughly into your nickel solution, preferably at night, at the close of the day's work. Make similar additions whenever the pitting re-occurs. Your polishing and cleansing methods are evidently satisfactory.—C. H. P. Problem. 3,481

SCRATCH BRUSH FINISH

Q.—We are trying to get a scratch brush finish on brass plated steel, also on brass castings without the use of the usual wet wheel and pumice. In other words, we want to approximate this finish by some cheaper method than the usual one.

A.—To produce an old brush brass finish upon brass plated steel, try tumbling in a mixture of sawdust and pumice stone used dry. Firms which manufacture brass plated steel chain for the lighting fixture trade, use this method either dry or wet. If the wet method gives the best results, then use coarse sawdust, only slightly moistened with water. After finishing by either method, wash the product thoroughly in cold and hot waters. Dry out with sawdust or by the aid of a centrifugal dryer, then lacquer as usual.—C. H. P. Problem. 3,482

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST

1,559,041. October 27, 1925. **Method and Apparatus for Continuously Coating Roofing Elements Electrolytically.** Julius H. Gillis, Elizabeth, N. J., assignor, by mesne assignments to Anaconda Sales Company, a corporation of Delaware.

A process of coating roofing elements of the type described which comprises supporting a series of elements upon a plurality of electrical conductors within an electrolytic cell, the conductors extending transversely of the series of elements, and moving said elements through the cell in such manner that substantially all of the surface of the individual element to be coated comes repeatedly in contact with a conductor.

1,559,620. November 3, 1925. **Alloy and Method.** Frederick W. Karitzky, Garwood, N. J., assignor to Henry B. Newhall, Plainfield, N. J.

An alloy comprising about 85% of zinc, 10% of aluminum and 5% of tin.

1,559,963. November 3, 1925. **Treatment of Copper Alloys.** Friedrich Heüsler, Dillenburg, Germany, assignor to the Firm of Isabellenhuette Gesellschaft mit beschränkter Haftung, Dillenburg, Germany.

The method of increasing the hardness and elastic limit of alloys containing a predominant proportion of copper and relatively small proportions of manganese and aluminum which consists in subjecting the alloys after they have been cast, rolled or forged, to a prolonged heating treatment at a temperature of approximately 200° C. to 250° C.

1,560,335. November 3, 1925. **Process of Improving Alloys and Metals.** Johann Czochralski, Frankfort-on-the-Main, Germany, assignor to American Lurgi Corporation, New York, N. Y.

Process of producing single-crystal metal structures of predetermined physical characteristics, which consists in initially cold-working the metal structure to impart to it definite physical qualities, then maintaining the metal thus treated for an extended period at a relatively low re-crystallization temperature favorable to nucleus formation and then raising the crystallization temperature at a relatively high rate and maintaining the crystallization temperature until the conversion to a single crystal structure is completed.

1,560,444. November 3, 1925. **Process for Producing Copper Coatings on Nonmetallic Substances.** Max Volmer, Hamburg, Germany.

A process for producing a reflecting copper lining in a double-walled vacuum vessel consisting in first depositing a thin, hardly visible covering of silver on the inner surface of the vessel, producing a copper coating on the said covering, heating the vessel whilst evacuating the space in the double wall, and in subjecting the copper coating to the effect of reducing gases whilst the vessel is heated.

1,560,838. November 10, 1925. **Coating for Metal Molds.** Daniel H. Meloche, Detroit, Mich., assignor to Earl Holley, Detroit, Mich.

A wash for giving a protective coating to metal molds, comprising water containing a small quantity of "C" grade sodium silicate in solution and a relatively large quantity of a refractory powder in suspension.

1,560,845. November 10, 1925. **Alloy.** Melvin E. Page, Muskegon, Mich.

An alloy composed of the following metals in substantially the following proportions: aluminum 93.20%; gold 4.55%; copper 2.25%.

1,561,956. November 17, 1925. **Manufacture of Cores.** William G. Thomas, South Orange, N. J., assignor to H. H. Thomas, Summit, N. J.

A core compound comprising sand, emulsified asphalt and water.

1,562,041. November 17, 1925. **Metal and Its Manufacture.** Aladar Pacz, Cleveland, Ohio, assignor to General Electric Company, a corporation of New York.

The method of reducing one or more metals from compounds thereof which consists in briguetting said compounds intimately mixed with finely divided aluminum above 80 mesh, and igniting one of more of the briquettes.

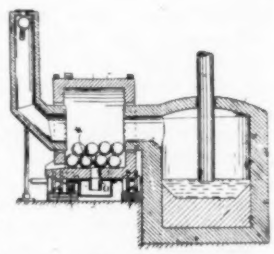
1,562,196. November 17, 1925. **Holder for Carrying Pig Lead.** Harry Abrams, Syracuse, N. Y.

A holder for carrying pig lead, consisting of a wire having one end bent into the form of an ellipse with a portion of the ellipse flattened to form a handle and the end of the wire bent around the main body of the wire, the other end of the main body of the wire being bent back on itself and twisted around to permit of its convenient insertion through the channels through a series of lead blocks, the lower end of the wire being bendable to a position at right angles to the main body of the wire to form an approximately T-shaped retaining element.

1,562 269. November 17, 1925. **Process for Tempering Light Alloys.** Glen Lenardo Williams, Detroit, Mich.

An electrolytic method for treating light alloys which consists in immersing the alloy in a hot solution of a salt of a heavier metal, subjecting the solution while heated to an electrolyzing current with the alloy active as the cathode until the alloy surface has taken up metal from the solution, and then quenching the alloy in cold water.

1,562,473. November 24, 1925. **Process and Apparatus for Condensing Zince Vapor.** Oystein Ravner, Christiania, Norway, assignor to Det Norske Aktieselskab for Elektrokemisk Industri, Christiania, Norway, a Business Entity.



A condenser for zinc vapors comprising a revolving drum and a stationary tube connected with the drum in such manner that the condensate formed in the tube will automatically fall back into the drum.

1,562,654. November 24, 1925. **Method of Producing Alloys.** Aladar Pacz, Cleveland Heights, Ohio.

The process of producing alloys which contains the step of treating with aluminum a double fluoride of sodium with one of the component metals in a molten bath of the other component metal, whereby the aluminum replaces the first named component metal from its compound with the fluorine.

1,562,655. November 24, 1925. **Process and Composition of Matter for Deoxidizing Metals and Alloys.** Aladar Pacz, Cleveland Heights, Ohio.

The process of refining metals and alloys which contains the step of incorporating in a molten bath of the same an intimate mixture of aluminum powder and sodium silico-fluoride.

1,562,710. November 24, 1925. **Method of Treating Metallic Objects and Resulting Products.** Charles P. Madsen, New York, N. Y., assignor to Madsenell Corporation, New York, N. Y., a corporation of New York.

The method of preparing iron, steel or equivalent surfaces to receive adherent and impervious metallic coatings, which comprises making the object to the coated the anode in a bath containing sulphuric acid of more than about eighty-six per cent strength while maintaining the bath at a temperature above normal.

1,562,711. November 24, 1925. **Coated Metallic Article and Method of Making the Same.** Charles P. Madsen, New York, N. Y., assignor to Madsenell Corporation, New York, N. Y.

As an article of manufacture, a flexible metal base provided with an adherent, workable electrodeposit of a "nickel metal."

1,562,958. November 24, 1925. **Alloy.** Charles E. Hansen, Providence, R. I.

A metal alloy containing more than fifty per cent gold, nickel and iron each in substantial amounts, and manganese or magnesium in an amount substantially less than the iron and nickel but sufficient to increase the tensile strength and workability of the substance.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST

The Gross Lead-Coating Process

Written for The Metal Industry by ANDREW M. FAIRLIE, Consulting Chemical Engineer, Atlanta, Ga.

Briefly, the Gross Lead-Coating Process consists in so preparing articles made of steel, wrought iron, cast iron, brass, bronze, copper, etc., by means of a simple preliminary treatment, that such articles will take a permanent, firmly adherent, and flawless coating of lead by immersion in a bath of molten lead.

The principal objections to lead-coated iron and steel prepared by prior processes are that they yield a lead-coating which is either not permanent, not firmly adherent, or not flawless. The failure of prior lead-coating processes may usually be ascribed to the use of tin, zinc, or solutions of the chlorides of these metals, as the flux for inducing the lead-coating to adhere to the iron. The success of the Gross formula is claimed to be due to the avoidance of tin and zinc, as well as of all other metals which are readily attacked by acids.

Iron and steel articles lead-coated by the Gross Process can be secured only from the Gross Lead-Burning and Coating Company, Louis Gross, president, and L. R. Schlundt, secretary, West 73rd Street and Clinton Road, R. F. D. No. 4, Brooklyn Station, Cleveland, Ohio. This company started in business in its own shops early in January, 1925, and as the merits of the process become known, the business is rapidly expanding.

Louis Gross, the inventor of this process, is a practical lead-burner, and has plied his trade successfully for many years. An

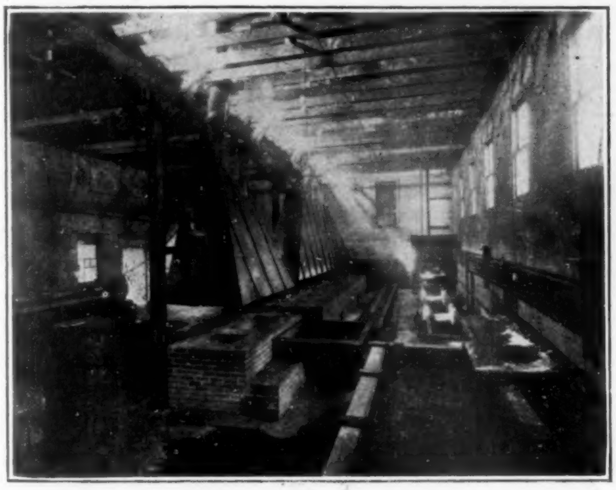


FIG. 1 DIPPING KETTLES

Austrian by birth, he has been in this country several times, and has lived here continuously for the past three years. Mr. Gross states that for many years he, and his father before him, had been working to perfect a formula whereby steel or iron could be prepared, by means of a simple dipping process, to take a permanent and firmly adherent coating of lead by immersion in a bath of molten lead. He claims that he perfected this process about seven years ago, and used it to a limited extent in some of the smaller European countries. Coming to this country about three years ago, he entered the employ of one of our chemical manufacturers as a lead-burner, and while so employed, he coated with lead two steel fans, using his private formula in preparing the flux. These two fans, it is stated, have been in continuous use ever since, at the front end of a sulphuric acid plant, without a breakdown.

The details for applying the lead-coating by means of the Gross formula vary somewhat with the size of the article to be coated. Articles small enough to go into the vats with which the shops are equipped, are first cleaned by pickling in dilute sulphuric acid, then rinsed in clean water, then dipped for an instant in a solution prepared according to the Gross formula, and finally immersed, while still wet, in a bath of molten lead. A frying sound is heard, caused by the boiling of the coating of solution on the surface of the steel, and the latter is kept immersed in the lead until the frying sound ceases. The dipped article has by that time acquired the temperature of the lead bath, and on removal (after two or three seconds' immersion), the lead-coating, of about the thickness of ordinary writing paper, is seen to be complete.

Additional thickness of lead cannot be applied by means of simple immersion. No matter how many times the article may be re-dipped in the Gross solution and in the molten lead, the thickness of the lead-coating remains substantially the same. But this lead skin, thin as it is, constitutes a foundation from which may be built up a homogeneous lead-coating of any desired thickness, by means of the ordinary lead-burner's flame and burning bar.

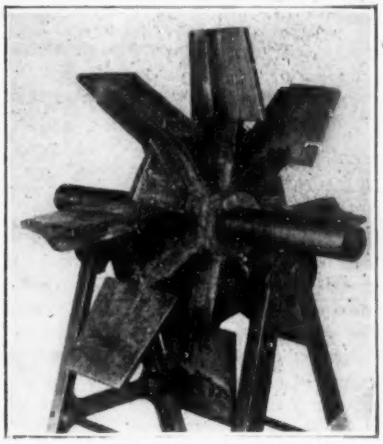


FIG. 2. LEAD COATED FAN IMPELLER

There are, therefore, two classes of lead-covered products prepared by the Gross process:

1. Lead-dipped products, which are covered by a skin of lead, of about paper thickness.
2. Lead-coated products, which have, in addition to the aforesaid skin, an extra thickness of lead applied by means of burning bar and oxy-hydrogen flame.

Iron and steel articles too large to go into the vats are thoroughly cleaned by means of emery wheels. The Gross flux is then applied with a brush, and while the article is still wet, lead is applied by the lead-burner, using the burning bar and oxy-hydrogen flame. Only Class 2 products can be prepared by this method, since the thin skin of lead can be procured only by immersion. Thus far, a thick coating of lead has been wanted on all large objects, and so no need has yet been felt for a thin-skinned lead-coating on objects of large size. When the need arises, it will be met by installing in the shops dipping vats of larger size.

Fig. 1 shows the dipping kettles, and Fig. 2, a lead-coated steel fan impeller for sulphuric acid plant, on the balancing wheels. Fig. 3 shows lead-burners at work applying the lead coating to fan impellers in the Gross shops. The hub is of cast steel, and the arms are of steel angle-iron, welded to the hub by the electric welding process. After the steel frame is assembled, all dirt and rust is cleaned off by pickling, and then the Gross flux is applied a little at a time, and lead from a burning bar, melted by means of the lead-burner's flame, is allowed to flow on to the moistened steel, and is kept molten for a second or two, to secure firm adhesion. The lead-burner then goes on to an adjoining surface, and proceeds in the same manner as before until the entire steel frame is coated with lead. He then builds up the thickness of the lead-coating by melting more lead on to the initial lead-coating, constantly scraping off oxidized or tarnished lead, until he obtains a coating of the desired thickness, which is kept uniform all over by constant and careful gauging. The fan in the photograph was coated all over with a thickness of one-quarter inch of pure, soft lead. The shaft is "lead-dipped" by the immersion method, and the wheel and shaft are crated separately for shipment to destination. After the shaft has been keyed into the hub, an additional coating of lead is burned to the dipped coating on the projecting ends of the shaft, and this can be done by any experienced lead-

FIG. 3. LEAD BURNERS AT WORK

burner. The lead-coating of the shaft is then burned to the lead-coating of the hub, to produce a complete lead-coated job. The extreme ends of the shaft, which are outside the fan housing and rest in the bearings, do not receive the extra thickness of lead.

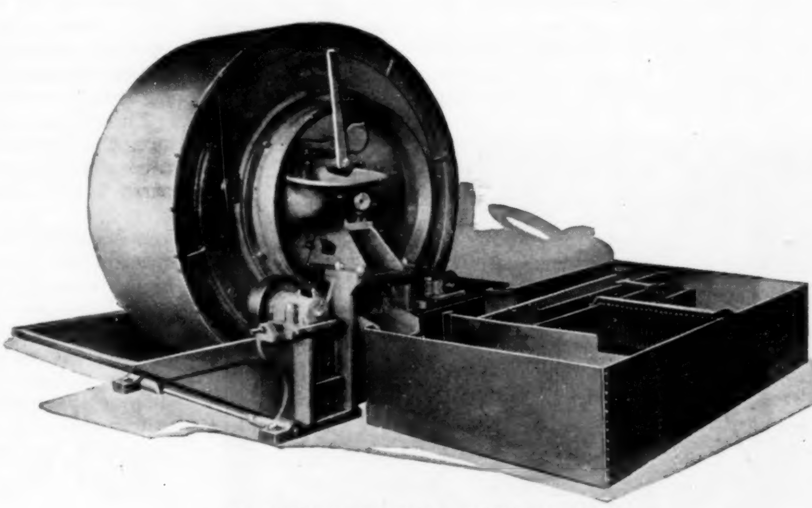
USES FOR THE GROSS LEAD-DIPPING AND COATING PROCESS

Reference has been made above to two classes of products: (1) Lead-dipped products; (2) Lead-coated products. The lead-dipped products are rust-proof, and for many purposes, for example, where it is desired to protect steel from rusting or from damage due to exposure to mild acid fumes, this skin-thick coating is all that is needed. Steel-sheets, corrugated iron, angle iron, tees, channels, I-beams, bolts, nuts, etc., lead-dipped, will have a much longer life, if used in the construction of acid plants, than ordinary steel work. Lead-dipped nails, screws, hinges, hasps, staples, and the like, will last many times as long as the undipped articles. On the other hand, iron and steel articles designed to come into direct contact with liquid sulphuric acid, or with the fumes in the interior of acid plant chambers or flues, would need a lead-coating of considerable thickness, in order to be enduring. Such articles as steel fan impellers, dampers, cooler shells, cooler partitions, plug stems, if made of steel, would need to be lead-coated, rather than merely lead-dipped.

METAL RECLAIMING MILL

The Standard cinder crushing and metal reclaiming mill is used by a number of brass foundries and casting shops throughout the United States and Canada for recovering metal from cinders, slag, skimmings, old crucibles, sweepings, etc. It is made by the Standard Equipment Company, Inc., New Haven, Conn.

The first mill of this type was put in actual service about 12 years ago, but during which time they have continually made changes and new developments, so that the present mill embodies all the improvements. One very important improvement has been the use of a 12% manganese cast steel annealed bushing in the top crushing roll, which does not require lubrication. The crushing rolls are also made of 12% manganese cast steel, but unannealed. These rolls with bushing will give good service, it is stated, without replacement for one to three years.



STANDARD CINDER CRUSHING MILL

Another important feature claimed for the Standard mill is the means for circulating the water so that one filling of water is used over and over, which effects a considerable saving on water in cities where the water supply is metered. This circulation of water is accomplished without a pump.

There are a number of foundries who hand pick the metal from their cinders or screen their cinders that do not realize they are losing or wasting about 5% of their metal. This, it is stated, was proved by an actual test run through a Standard mill on some 2,700 lbs. of hand-picked cinders, from which the mill separated and recovered 125 lbs. of clean metal. In order to convince any casting shop, brass, bronze, or aluminum foundry of the metal content in their waste material, The Standard Equipment Company, Inc., will run a barrel through their demonstrating mill and furnish data as to time required, horse-power consumed, and return the metal reclaimed without cost, other than the freight and cartage on the shipment of material to and from the foundry.

The manufacturers are prepared to furnish this mill in four sizes, with capacities from 1,000 lbs. to twenty thousand pounds of feed per hour.

HARD RUBBER FOR PLATING SHOPS

The Belke Manufacturing Company, Chicago, Ill., has added to its numerous products for plating shops a line of hard rubber pipes and fittings and hard rubber buckets, dippers and pitchers. They are equipped to furnish hard rubber pipe in any length up to 10 feet. Ends are made plain or threaded, as required; also, special threading. Fittings made include stop-cocks, tees, ells, couplings, unions, plugs, flanges and nipples.

The buckets, dippers and pitchers are particularly suited for handling acids and chemicals. They are light and strong, being reinforced with steel cores.

HARD RUBBER DIPPER AND PIPE FITTING

NEW CRODON PLATING PLANT

The Chemical Treatment Company, Inc., of 26 Broadway, New York City, the producers of Crodon, the chrome-alloy plate developed by Dr. Colin G. Fink of Columbia University, has announced the recent purchase of another plant at Waterbury, Conn., which will become Plant No. 2 of this company's production units.

The announcement in May of this year of the perfection of Crodon, after years of experimentation with methods of utilizing the hardness and corrosion-proof characteristics of chromium in the form of a plate or sheathing over other metals, brought hundreds of inquiries from manufacturers of metal products of all descriptions. Samples of the products of a large number of these manufacturers have been plated with Crodon for test purposes. The success of such tests brought a steadily increasing volume of production work which has severely taxed the facilities of the original production unit in New York City, and has made necessary the acquisition of this new property.

WATERBURY PLANT, CHEMICAL TREATMENT COMPANY

The Waterbury plant was formerly used as a brass tube mill and some of the equipment will be available for the production of Crodon, the remainder to be sold. The installation of other machinery and equipment is now being made and the company's engineers expect to have this unit in regular operation before the end of the year. The present buildings offer 24,000 square feet of floor space which can readily be added to since nine additional acres of land were included in the purchase.

H-ION COMPARATOR SET

The LaMotte H-Ion Comparator Set is made by the La-Motte Chemical Products Company, Baltimore, Md. It is a portable outfit, as all necessary reagents and equipment are contained in a polished wooden case approximately 5½ x 6 x 1½ inches. The case serves as a combined comparator block and tube rack and permits the viewing of three double rows of tubes simultaneously.

LA MOTTE COMPARATOR SET

The equipment consists of nine color standards and one tube of distilled water, each 15 mm. in diameter; three extra graduated test tubes of the same bore and thickness; and two tubes of standardized indicator solution, one of which is fitted with a 0.5 ml. pipette and nipple for measuring out the indicator solution.

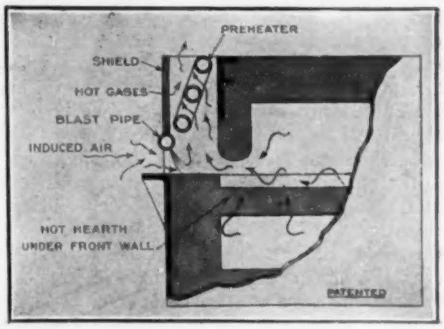
If the solution to be tested is colored or turbid, all three test tubes are filled to the mark with the solution and are placed in the three holes back of the slots. To the middle tube 0.5 ml. of the indicator solution is added. The tube of distilled water is then placed in front of this tube containing the indicator, and color standards are substituted in the remaining two holes in front of the other two tubes of the unknown until a color match is obtained. Thus the effects of color and turbidity are eliminated and results accurate to 0.1 pH. are obtained.

With clear and colorless solutions comparisons are made directly with the color standards without a color screen.

Since the ranges of the various sets of color standards overlap, measurements can be checked with two indicators, thus insuring accuracy.

HEAT-TREATING FURNACE

The W. S. Rockwell Company, 50 Church street, New York, has put out a new heat-treating furnace of the "Economizer Shield Type." This type furnace is developed to meet the need for better heating practice, more comfortable working conditions in the heat treatment of a great variety of small metal parts and requirements for reasonably continuous production without automatic furnaces. The illustration shows the important features of the economizer shield.



ECONOMIZER SHIELD
Section showing method of protecting the operator, preheating air for combustion and maintaining a hot hearth under the working opening.

Advantages claimed are as follows:

- Comfortable working conditions.
- Better heating conditions for the metal.
- Flexibility in range of temperature, time and load.
- Accurate control of temperature and atmosphere.
- Decreased cost of operation and maintenance.
- Greater heat storage and slower cooling.
- Lower cost of installation, with heavier construction.

DANIELS PLATING MACHINE

The Daniels & Orben Company, Inc., 81 Walker street, New York, and Newark, N. J., has had on the market a new type of plating barrel. This barrel, shown in the illustration, is of simple construction and operation, and is said to be most efficient. All the elements in it revolve—the work, anodes and solution. The anodes are placed very close to the work to insure a quick deposit.

The barrel takes the ordinary load with only 8 gallons of solution. The current consumption is small and according to the manufacturers, results obtained in this barrel have been most excellent. The contact plates are so arranged that the metal is deposited directly on the articles to be plated. The constant rotation of the work, anodes and solution results in complete agitation and a uniform deposit. The design of the machine is such that the work can be inspected while in operation.

DANIELS PLATING MACHINE

This barrel can be seen in operation either in the New York warehouse or the Newark factory of the Daniels & Orben Company. The barrels are shipped complete, including anodes.

PLASTIC COPPER CARBONATE

In the old days, that the plater was in the habit of dissolving a certain amount of copper carbonate in aqua ammonia for a stock solution and each day, adding a few ounces from this stock solution to the bath. Those were the days when care and patience were used in the making of carbonates of copper. Then came the keen competition, production methods were gone over so as to bring about the quickest turnover possible, with the result that the bulk of the market carbonate was a heavy product only partly soluble in ammonia.

Lately there seem to have been reports of a tendency to return to the old ways of doing things and the C. G. Buchanan Company of Cincinnati, Ohio, supplying quantities of copper carbonate for electro-plating purposes and this brings up another phase of the situation. Basic copper carbonate suffers a certain loss in drying, even if such drying (as they do it) is performed in vacuum. A marked quantity of the basic radical suffers decomposition and this is what causes the non-soluble qualities when aqua ammonia is used. The logical solution would be for those who want to use copper carbonate at its best, to secure the plastic material, the real plastic product, just as it comes from filter presses, not a dry product that has been wetted down to a plastic state. Sufficient differential in price can be made to make it worth while from many angles, the usual moisture content is 50% so that at 18 cents per pound for dry, the plastic could be bought for possibly 8 cents per pound.

The product is entirely soluble in aqua ammonia and the only possible difficulty would be in the freezing of packages in transit. However, this is said to be only a minor detail. Freezing does not hurt it in any way. Heat, not cold, does the damage, so all that is necessary is to put the package in a place where it will thaw out and then use it in the regular way.

FOUNDRY SHOES

The Rohrbacher Shoe Company, Boston, Mass., manufactures shoes for factory and foundry use, called the Artisan Shoe. It is built from the workman's point of view, and designed to fill the requirements for shoes of this type. It is a Goodyear welt shoe, with a heat resisting, all-leather, chrome upper, and a fire-proof composition sole. It is lighter than the average work shoe and pliable.

There is no lining, rough leather, or metal to touch or chafe the feet and it is equipped with fasteners, which make it easy to put on and quick to take off, insuring at the same time a snug fit around the instep and ankle.

ELECTRIC GLUE POT

The Hynes & Cox Red Crown Automatic Electric Glue Pot has a removable glue kettle surrounded by a hot water bath, which is heated electrically and its temperature is automatically controlled by a simple snap action thermostat. This keeps the glue temperature just right and, as the water is entirely enclosed and never boils, it does not evaporate. Even if the pot is not filled with water the glue cannot be overheated, as the thermostat is applied in a way to prevent this. The heat is economized by insulation between the pot walls. The heavy duty factory type cable and clamp plug provide reliable connection to any lamp socket. Red Crown Pots are made in one, two and four-quart sizes for 110 or 220 volts.

RED CROWN GLUE POT

EQUIPMENT AND SUPPLY CATALOGS

Lift Trucks. Barrett-Cravens Company, Chicago, Ill.

Portable Ovens. Swartwout Company, Cleveland, Ohio.

Mine Fans. American Blower Company, Detroit, Mich.

Mechanical Drive Turbine. General Electric Company.

Spray Booth. De Vilbiss Manufacturing Company, Toledo, Ohio.

Water Level Indicator. W. B. Conner Company, Inc., New York.

Ventilation in the Home. American Blower Company, Detroit, Mich.

"Sirocco" Air Washers. American Blower Company, Detroit, Mich.

Amsler Testing Machines. Bulletin No. 34. Herman A. Holz, New York.

Anaconda Phosphor Bronze. American Brass Company, Waterbury, Conn.

Water Level Gauges for Steam Boilers. Bristol Company, Waterbury, Conn.

Foremanship. Chamber of Commerce of the United States, Washington, D. C.

Stainless Steel in the Home. American Stainless Steel Company, Pittsburgh, Pa.

Stainless Steel in Industry. American Stainless Steel Company, Pittsburgh, Pa.

Industrial Control Catalog. GEA-257. General Electric Company, Schenectady, N. Y.

Centrifugal Air Compressors, Signal-stage. General Electric Company, Schenectady, N. Y.

Electrical Melting Pots For Soft Metals. General Electric Company, Schenectady, N. Y.

Arc Welding Sets, Gas Engine-Driven. General Electric Company, Schenectady, N. Y.

"What's in the Box?" A New Year's card from Chase Companies, Inc., Waterbury, Conn.

Expenses of Doing Business. Chamber of Commerce of the United States, Washington, D. C.

Brass Traffic Stops for Marking Roadways. Bridgeport Brass Company, Bridgeport, Conn.

New Year's Greeting from A. L. Haasis, of Joseph Dixon Crucible Company, Jersey City, N. J.

Collection of Business Figures. Chamber of Commerce of the United States, Washington, D. C.

Co-operative Industrial Research. Chamber of Commerce of the United States, Washington, D. C.

Everdur Metal. An acid-resistant, copper-base alloy. Du Pont Everdur Company, Wilmington, Del.

General Electric Catalog. Complete catalog 6001-B of the products of the General Electric Company.

Farrel Products. A full list of products of the Farrel Foundry and Machine Company, Ansonia, Conn.

Hardinge Conical Mills. Ball and pebble mills for grinding and pulverizing. Hardinge Company, New York.

What Price Progress? The stake of the investor in the development of chemistry. Chemical Foundation, Inc., New York.

Belke Plating Products. Hard rubber pipe, fittings, pails, dippers, pitchers and plating racks; agitators, filtering installations, chemical pumps and pipe fittings. Belke Manufacturing Company, Chicago, Ill.

CALENDARS

Calendars for 1926 have been received from the following companies.

New York Central Railroad.

J. W. Paxson, Philadelphia, Pa.

Abrasive Company, Philadelphia, Pa.

Standard Rolling Mills, Brooklyn, N. Y.

West Virginia Pulp & Paper Company, New York.

John O. Golden, Portland, Ore. Calendar on brass backing with thermometer attached.

The American Brass Company, Waterbury, Conn. Annual filler for the decorated sheet brass calendar back.

Joseph Dixon Crucible Company, Jersey City, N. J. Illustrated with photograph of a pouring operation in a brass foundry.

General Electric Company, Schenectady, N. Y. This calendar is illustrated with attractive paintings showing the numerous applications of electric power.

ASSOCIATIONS and SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS

Progress in 1925—Plans for 1926

AMERICAN FOUNDRYMEN'S ASSOCIATION

HEADQUARTERS, 140 S. DEARBORN STREET, CHICAGO, ILL.

The development of the activities of the American Foundrymen's Association during the year has been one of increasing value to the foundry industry. Membership growth has been steady and the association has continued to assume a position of greater importance among the technical organizations of the country. Co-operation with other organizations in advancing the interest of the foundry industry has been greatly augmented during the year.

Total exhibit space occupied at Syracuse was 57,370 sq. ft. One hundred and eighty-seven firms exhibited, using an average of 206 sq. ft. Total space used at Milwaukee last year was 55,164 sq. ft. In total of exhibit space used at A. F. A. exhibitions, Syracuse ranks third; Philadelphia, 1919, second, with 60,400 sq. ft., and Columbus, 1920, first, with 76,600 sq. ft.

THE SYRACUSE MEETING

The Syracuse meeting is now history and those members who were not fortunate enough to be able to attend have read detailed accounts of the convention in the technical press. There are, however, certain features which bear emphasizing.

In all forty-four technical papers were presented before the A. F. A. sessions in addition to numerous committee reports. The grey iron foundry section led the list with eleven papers, closely followed by ten and eight for the non-ferrous and sand control sections.

Discussion at all the sessions was excellent, being better than at any previous convention. The sessions were so grouped that everyone at the convention could attend the sessions with topics of interest to him.

An innovation was the session devoted to foundry refractories problems. The method of presentation was that of discussing questions which had been sent in previous to the meeting.

The sessions on costs and sand control because of their universal interest to foundrymen attracted the largest attendance and brought forth excellent discussion.

The field of non-ferrous metals was more thoroughly discussed than at previous meetings. Copper base casting alloys problems were reviewed at a joint session, and at a round table discussion. The round table discussion, at which extemporaneous questions were propounded, was exceedingly popular and proved of such value that further meetings of the same character on this and other phases of foundry practice will be held in the future.

L. W. Olson was elected to honorary membership in the association at this business meeting. Previous to his term of office as president, Mr. Olson held the office of vice-president, and had served as a member of the board of directors.

The presentation of the first Joseph S. Seaman and W. H. McFadden gold medals made a memorable occasion of the annual banquet held at the Hotel Syracuse. These were presented to Dr. Richard A. Moldenke and Dr. Robert J. Anderson, respectively.

1926 MEETING

Of especial interest to foundrymen attending the Second International Foundry Congress to be held in Detroit the week of September 27, 1926, will be the symposium on permanent and long life mold castings. This phase of foundry practice, which has assumed such importance in the past four years, will be thoroughly discussed at the meeting, the discussion being planned to cover non-ferrous, iron and steel practice, and to be international in scope.

The Cothias and similar processes used in England and France will be explained. The American practice developed in using oil cooled molds for pistons, the process of using zinc impregnated molds and the many other special developments in iron, steel and non-ferrous field will be considered.

The committee organizing this symposium, under the direction of Jesse L. Jones, Metallurgist, Westinghouse Electric & Manufacturing Company, East Pittsburgh, will welcome information from any who have been instrumental in developing or carrying on work in this field of casting.

INSTITUTE OF METALS DIVISION

HEADQUARTERS, 29 W. 39TH STREET, NEW YORK

The Institute of Metals Division of A. I. M. E. participated with the American Foundrymen's Association at the Fall meeting in Syracuse, New York, in one of the most noteworthy meetings that we have had for many years.

The round table discussion on brass foundry problems was headed by Mr. George K. Elliott. The topics discussed were most interesting and created an enormous amount of discussion.

S. Skowronski, Chairman of the Papers Committee of the Institute of Metals Division, prepared a most excellent program for the Syracuse meeting, and has completed an equally good one for the Winter meeting to be held in February, 1926.

From an organization standpoint there have been no changes of moment.

The Winter meeting in New York, and the Fall meeting with the American Foundrymen's Association is continuing to give the members the best type of program on both the theoretical and practical sides of the situation.

The annual lecture feature, with Dr. Carl Benedicks, of Stockholm, Sweden, occupying the platform, was a great success in February, 1925. The annual lecture of 1926 will be given by Dr. Paul Foote, of Washington, D. C., Bureau of Standards, and his subject will be "The Relation Between Metallurgy and Atomic Structure."

The membership of the Institute of Metals Division comprises the foremost metallurgists in the United States, and with the programs they are attracting the best class of members that it is possible to obtain. They are, however, particularly anxious to get members from the younger group of technically trained metallurgists.

NEW ENGLAND FOUNDRYMEN

HEADQUARTERS, EXCHANGE CLUB, BOSTON, MASS.

On December 9, 1925, A. A. Grubb, director of laboratories of the Ohio Brass Company, Mansfield, Ohio, described the improvements effected by that company along the lines of technical control of the foundry.

It is necessary to have control of raw materials, processes, product and losses and to develop and improve processes. The purpose of raw material control is to adapt supplies as nearly as possible to specifications as to determine if one is securing full value for money paid out and to hold producers of materials accountable. Adjustments in the matter of composition ingots alone has paid the company for the analysis of all raw materials.

The technical control of a product calls for five inspections for testing its fitness for service. By a series of charts maintained on the foundry floor for the molders' inspection, keen rivalry has been built up between the molding gangs, who strive to keep their charts as nearly perfect as possible.

The company also has made strides in the recovery of waste materials. A saving of at least half the cost of technical practice at the plant has been made by reclamation. The company discards no sands in its brass foundry. By a proper application of re-binding, used sands are reconditioned.

AMERICAN SOCIETY FOR TESTING MATERIALS

HEADQUARTERS, 1315 SPRUCE STREET, PHILADELPHIA, PA.

The year 1925 has been a significant one so far as the work of the American Society for Testing Materials in the field of metals is concerned, both in reference to the activities of its committees and the results of researches that have been brought out in the form of papers. A new Committee on Metallic Materials for Electrical Heating has been organized and some of the older committees have turned their attention to new fields and have brought out new specifications, or through the review of existing specifications have found that some revisions are necessary.

Possibly the most significant development during the year has been the intensive study given to the effect of temperature on the properties of metals. This is a field assuming constantly greater importance in view of the increasing needs for metals that will function satisfactorily when subjected to high temperatures.

During the past few years some attention has been given to the use of the X-ray in the examination of materials. The status of this work is very well set forth in a report prepared by Committee E-4 on Metallography. X-ray crystallography shows considerable promise in the study of the internal structure of metals and metal radiography has already received some practical applications in the foundry in the control of the manufacture.

Research on the fatigue of metals has been continued and progress in this field is marked by the presentation at the annual meeting of three papers treating of the subject.

Each year shows more importance being placed upon the study of corrosion. Although this subject was not featured to the extent of holding a symposium, as was the case at the annual meeting in 1924, much progress has been made during the year. Much attention is being given to accelerated tests for corrosion as is evidenced by the annual reports of Committee B-3 on Corrosion of Non-Ferrous Metals and Alloys and Committee A-5 on Corrosion of Iron and Steel.

In the field of non-ferrous metals in addition to the investigations on corrosion, mention should be made of the report of Committee B-2 on Non-Ferrous Metals and Alloys, which presented revisions of a number of specifications as well as new specifications for Muntz metal condenser tube plates.

Organization of the Committee on Metallic Materials for Electrical Heating was effected on October 27 when the committee met in Cleveland. It consists of the producers of the materials and representatives of a number of the consuming interests. Both from the domestic viewpoint as well as from that of the many manufacturers using electric furnaces, the activities of this new committee will be of considerable economic importance.

1926 ANNUAL MEETING

Announcement is made by the Executive Committee that the Society will return to the Chalfonte-Haddon Hall, Atlantic City, N. J., for its Twenty-ninth Annual Meeting, to be held over the dates of June 21 to 25, 1926.

PLANS FOR 1927 MEETING UNDER CONSIDERATION

At the recent Executive Committee meeting there was some discussion regarding the possibility of holding the 1927 Annual Meeting at some place other than Atlantic City and the Executive Committee has accordingly directed its Committee on Annual Meeting, of which the members are J. A. Matthews, Chairman, A. E. Jury, E. F. Kenney, and K. G. Mackenzie, to make a canvass of other places at which the 1927 meeting might be held and to report its recommendations.

NATIONAL ASSOCIATION OF BRASS MANUFACTURERS

HEADQUARTERS, CARE OF WM. M. WEBSTER, CITY HALL SQUARE BUILDING, CHICAGO, ILL.

On Thursday, December 10, 1925, a highly satisfactory meeting of the National Association of Brass Manufacturers was held in New York City after a busy four days session. The attendance was the largest ever had at any meeting of the Association.

The various sessions took up the new Official Catalog work which will make its appearance on January 1st, 1927, and in which will be included many new types and styles of goods and modern fixtures.

The report of the Credit Department indicated that it was rendering a good service to members, and the feeling of the delegates from all sections of the country was quite optimistic, all sharing in the views that 1926 would be one of the best years in our history.

The Association will shortly issue a very attractive booklet, colorful in its make-up, indicating the proper and improper method of installing, using and caring for brass goods when in place.

At the final session, the Convention went on record as approving the Kelly H. R. Bill No. 11 on the matter of resale.

In the South Garden of the Hotel Astor on the evening of Wednesday, the ninth, the Annual Banquet was held, after which all the delegates and their wives pleasantly spent the remainder of the evening at a Theatre Party at the Vanderbilt Theatre.

On Thursday the following officers were elected for 1926:

R. L. Ottke, Pennsylvania, President; H. C. Bulkeley, Illinois, 1st Vice-President; Wilson Cary, Maryland, 2nd Vice-Pesident; R. B. Hills, Massachusetts; H. C. Sanders, Missouri; Earl Roberts, Michigan; E. A. Eckhouse, Ohio; Wm. Spence, Jr., Wisconsin; B. T. Hain, Illinois; Karl Legner, Pennsylvania, Councillor to the U. S. Chamber of Commerce; Nelson Lawnin, Missouri, Director on the National Trade Extension Bureau; A. C. Brown, Illinois, Delegate to the Central Supply Association.

1926 MEETING

The next meeting will be held at the West Baden Springs Hotel, West Baden, Indiana, on March 24, 25, 26, 1926.

AMERICAN ELECTRO-PLATERS' SOCIETY

HEADQUARTERS, CARE OF R. STEUERNAGEL, 1508 CONCORDIA AVENUE, MILWAUKEE, WIS.

A REPORT FROM R. STEUERNAGEL, SUPREME SECRETARY-TREASURER

With the passing of 1925 the American Electroplaters' Society can look back at the most successful year of its existence as shown by the activities of the branch societies, and the recognition by manufacturers operating plating departments, of the merits of this Society by calling upon the employment bureau when in need of competent help to take charge of their plating departments. The demand for foreman platers, members of the A. E. S., has exceeded the supply; every week brings inquiries. They come from all sections of the country although the branches only extend from Montreal in the East to St. Louis in the West. The time is now at hand for the platers of the western states to organize branch societies as there have been many inquiries for A. E. S. platers by the manufacturers of the western states. The organizing of A. E. S. branches in the far west should be taken up at the coming convention in Newark, N. J.

The most prominent feature of the past year was the completion of the organization and the formulating of plans to finance the continuing of the research work of plating by the Research Committee in conjunction with the Bureau of Standards in Washington, D. C. This project was adopted at the last convention held in Montreal, Canada. The Research Committee appointed to handle this problem is making good progress and this project will undoubtedly be a success. The preliminary work has been done and the manufacturers are responding to the call sent out by this committee. There is still a lot of work to be done and the manufacturers will have to aid this committee by sending their contributions in order to carry out the plans as proposed.

The membership drive is second in importance only to the work of the research committee. Supreme President E. J. Musick certainly has awakened the branches by his appeal for a membership drive to raise our membership to 1,200. The response for

this cause has gone past all expectations. The drive has caused much activity in the branch societies and the interest taken in this work shows that with new timber added to the old the A. E. S. branches can look to a better attendance and more interesting meetings than ever.

The records of attendance at the recent conventions show that the manufacturers are waking up to the fact that their foreman platers should attend these conventions. Non members as well as members have attended and every manufacturer operating a plating department should deem it his duty to have his plater attend the electroplaters' annual convention in Newark, N. J., July 1, 1926.

NEW YORK BRANCH

HEADQUARTERS, CARE OF JOHN E. STERLING, 2595 45TH ST., ASTORIA, L. I., NEW YORK

The December meetings of the New York Branch A. E. S. were well attended. The branch is doing its share in the membership drive conducted, having put through 10 new applicants in these last two meetings.

The Seventeenth Annual Founders Day and Banquet of the New York Branch of the American Electro-Platers' Society, will be held Saturday, February 20, 1926, at the Aldine Club, 200 Fifth Avenue, (cor. 23rd St.) New York City, at 7 P. M. sharp.

There will be an open session, presided over by Charles H Proctor starting at 3:00 P. M. at which papers of interest will be read and discussed, by all persons present. There will also be addresses by some of the best men in the science of electroplating, such as: Dr. William Blum of the Bureau of Standards of Washington, D. C.; Chas. H. Proctor the Founder of this Society and Plating Chemical Editor of THE METAL INDUSTRY; Geo. B. Hogaboom the first Supreme President; Supreme Editor F. C. Mesle, and such other well known persons as C. G. Backus, and S. Skowronski who will address us on the mining and refining of metals, with the aid of moving pictures, which will be of great interest.

The Banquet will be the best ever. The Ladies will be there as usual, and dancing will follow the dinner.

Tickets can be obtained from members or the Secretary, John E. Sterling, 2595 45th Street, Astoria, L. I., N. Y.

ST. LOUIS BRANCH

HEADQUARTERS, CARE OF F. P. MENNIGES, 3205A ARSENAL ST.

The Thirteenth Annual Banquet of the St. Louis Branch, A. E. S. was held on Saturday, Jan. 16, 1926 at the American Annex. There was an Educational Session in the afternoon with George B. Hogaboom and A. P. Munning, Jr., as the principal speakers. There was a moving picture party for the ladies. The Banquet was held at 6:15 P. M. and dancing followed at 8:15.

AMERICAN ELECTROCHEMICAL SOCIETY

HEADQUARTERS, COLUMBIA UNIVERSITY, NEW YORK

CHICAGO MEETING

CHICAGO BEACH HOTEL, APRIL 22-24, 1926.

A preliminary outline of the Chicago Meeting program has been drawn up by the Chairman of the Local Committee, Dr. H. C. Cooper, and has received the hearty approval of the Board of Directors. The tentative program provides for two Round Table Luncheons—one for the Electrothermic and the other for the Electrodeposition Division. "Comparative Merits of Electric and Fuel-Fired Furnaces" will be the topic for discussion at the Electrothermic Round Table. The subject for the Electrodeposition Round Table Discussion has not yet been definitely selected and will be announced later.

WASHINGTON MEETING

The Washington Meeting has been provisionally scheduled for October 7, 8 and 9, 1926. Dr. Wm. Blum is Chairman of the Local Committee. "Materials for Extreme Conditions in the Electrochemical Industries" will be the subject of the symposium. Dr. H. W. Gillett, Chief of Metallurgy Division, Bureau of Standards, will be in charge of this session.

INTERNATIONAL FELLOWSHIP CLUB

HEADQUARTERS, CARE OF J. C. OBERENDER, CARE OF ZAPON COMPANY, NEW HAVEN, CONN.

The new International Fellowship Club, organized after the Montreal meeting of the American Electro-Platers' Society will hold its first meeting on Saturday, February 20, 1926. Details will be published in our February issue. For information address the Secretary, noted above.

BRITISH INSTITUTE OF METALS

HEADQUARTERS, 36 VICTORIA STREET, WESTMINSTER, LONDON, S.W. 1, ENGLAND

The year 1925 has witnessed a big growth in the Institute's Membership, as the following figures will show:

	December 31, 1924	December 31, 1925
Fellows	1	1
Honorary Members	3	3
Ordinary Members	1,423	1,547
Student Members	144	142
	1,571	1,693

The above represents the biggest year's addition to the roll for many years past.

A large proportion of the members enrolled during the year are resident in the United States, where there are now over 200 members, all of whom joined in order to receive the Journal of the Institute of Metals and the preprints of the papers to be read before the Institute. The growth of the Institute's Membership in the United States has been largely assisted by W. M. Corse. The Research Service, 706-7 Otis Building, Washington, D. C., the Honorary Corresponding Member to the Council for the United States.

The two usual half-yearly meetings were held in 1925, the first in London in March, and the second in Glasgow in September. At each there were presented over a dozen important Papers dealing with many aspects of metallurgical work. These Papers have since been published with discussions in the "Journal." *

A special meeting of the Institute of Metals was held in the month of May, when the Fifteenth May Lecture on "The Motion of Electricity in Metals" was delivered by the distinguished Dutch physicist, Professor H. A. Lorentz.

The work of the Corrosion Research Committee has been actively continued during the past year, culminating in the issue of a valuable booklet entitled "Notes on the Corrosion and Protection of Condenser Tubes," which summarises the work and experience of the Committee for the past ten years. Copies, price $1, can be obtained from the Secretary of the Institute.

1926 MEETINGS

The programme for 1926 includes three meetings of the Institute and a large number of meetings of its Local Sections. The first meeting will be the Annual General Meeting, to be held in London on March 10 and 11, at which upwards of 16 Papers are due for presentation and discussion. This will be followed on May 19 by the Sixteenth Annual May Lecture, to be given by Professor H. C. H. Carpenter, F. R. S on "Single Metallic Crystals and their Properties." The concluding meeting of the year—the Autumn Meeting—will probably be held on the Continent of Europe.

*For abstracts, see THE METAL INDUSTRY for April and October, 1925.

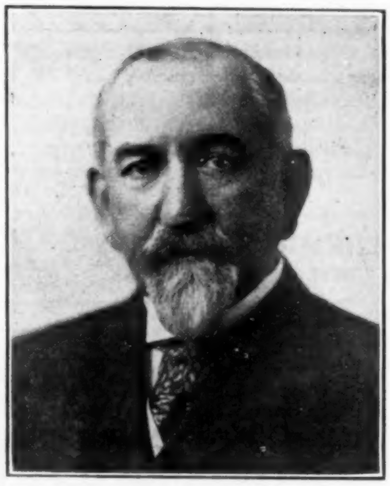
Personals

AMERICAN BRASS COMPANY EXECUTIVES

In our issue of August, 1922, we published the story of the growth and development of the American Brass Company in an article entitled, A Century of Brass Making. In the article were included biographies and portraits of the founders and officials, up to but not including the present officers. Below we give short descriptions of the careers of these present officers, all of whom have been with the American Brass Company for many years and who have retained their posts through the reorganization effected by the merger of their company with the Anaconda Copper Mining Company.

CHARLES F. BROOKER

Charles F. Brooker, chairman of the board of the American Brass Company, now a resident of Ansonia, Conn., was born in Litchfield, Conn., March 4, 1847. He entered the employ of the Coe Brass Company, of Torrington, as bookkeeper at the age of 17, becoming its secretary in 1870. On the death of Lyman W. Coe, his uncle, in 1893, Mr. Brooker succeeded him as president of the company. When the American Brass Company was formed he was elected its first president. Both in Torrington and Ansonia he held many important positions on the directorates of banking, water and manufacturing companies. He was for years a director of the New York, New Haven & Hartford Company.

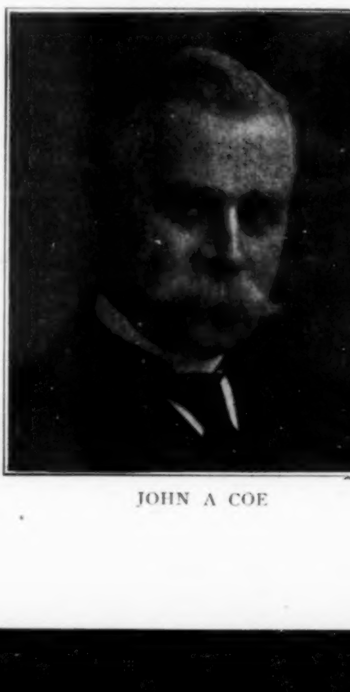


CHARLES F. BROOKER

About seven years ago he became chairman of the board. He is credited with being largely responsible for the merger with Anaconda and for the excellent price which stockholders of the American Brass Company got for their shares—$150 in cash and $150 in Anaconda stock for each American Brass share. He was a member of the Connecticut Assembly in 1875 and of the State Senate in 1893. He was a member of the Republican State Committee and the Republican National Committee for many years. He is a member of the Union League Club, the New England Society, the Engineers' Club, the Lawyers' Club, and the Transportation Club of New York, the New York Chamber of Commerce and the New York Yacht Club. He was the guest of honor at a banquet in 1924, attended by the leaders of most of the brass companies of the country, the occasion being the completion of 60 years employment with the American Brass Company.

JOHN A. COE

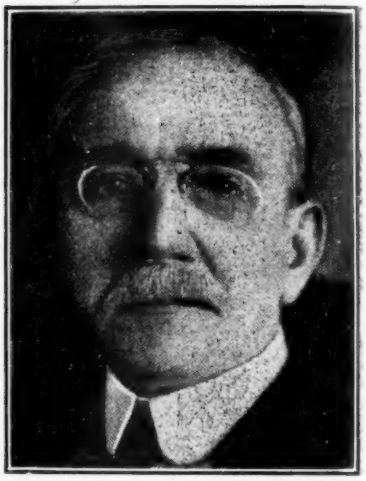
John A. Coe, president of the American Brass Company, was born in Beacon Falls, Conn., in 1868, and after graduation from the public schools entered the employ of the Osborne & Cheesman Company, a brass factory in Ansonia which later became the Birmingham Brass Company. In 1903 this company became part of the American Brass Company. Mr. Coe was then secretary and treasurer of the company. After the merger he became sales manager of the American Brass Company and in 1913 was elected vice-president, becoming president in 1919, when Mr. Brooker became chairman of the board. He is a director of the Citizens' National Bank, American Metal Hose Company, the Waterbury Savings Bank, of Waterbury, Conn., and the Turner & Seymour Manufacturing Company, of Torrington.



JOHN A COE

E. L. FRISBIE

E. L. Frisbie, vice-president of the American Brass Company, was born in Waterbury, November 22, 1854. His father, also E. L. Frisbie, was one of the developers of the brass industry, helping organize the firm of Brown & Brothers and being active in the Waterbury Brass Company. E. L. Frisbie, Jr., entered the employ of Brown & Brothers, and after 12 years' service entered the service of Benedict & Burnham Manufacturing Company, being elected secretary in 1885, treasurer in 1890 and president in 1896. When the American Brass Company took over this concern, he became vice-president of the larger company and acting president of the Benedict & Burnham branch. He is also president of the American Metal Hose Company and a director of the Colonial Trust Company and has served on various city boards. He has been in the brass business 53 years, and with the American Brass, or its predecessors, 41 years.



E. L. FRISBIE

C. F. HOLLISTER

C. F. Hollister, treasurer of the American Brass Company, was born in New Haven, Conn., April 15, 1880. He lived in that city until he was 22 years old, receiving his education at the schools there. After leaving New Haven, he located in Torrington, Conn., and entered the office of the Coe Brass Company, of that place. That soon after consolidated with other brass concerns to form the American Brass Company, and he continued to advance in the company until he became its treasurer, which position he has held for nearly 10 years. He served on the staff of ex-Gov. C. A. Templeton of Connecticut, with the rank of major, in the years 1923 and 1924.

C. F. HOLLISTER

EDWARD H. YATES

Edward H. Yates, secretary of the American Brass Company, was born in Canada. He has been with the American Brass

Company 19 years. He first entered the employ of the New York, New Haven & Hartford Railroad Company in 1894 and was with the railroad for 12 years.

In 1906 he entered the employ of the American Brass Company, Waterbury office, becoming chief clerk and secretary to the general superintendent. After a few years in this position he became secretary to John A. Coe, then vice-president of the company. When Mr. Coe became president six years ago, Mr. Yates was elected secretary of the company.

Mr. Yate's portrait was not obtainable at this time.

MAJOR W. JUDGE

Major W. Judge, assistant treasurer of the American Brass Company, has been with the company over 20 years. He was born in Waterbury and entered the employ of the Matthews & Williard Company (now owned by the Scovill Manufacturing Company) in 1895 as a cost clerk. In 1897 he became cost accountant for the Miller Manufacturing Company, of Torrington, and in 1901 went to the Pittsburgh Lamp Brass and Glass Company, of Pittsburgh, as chief accountant. He then worked for the Manhattan Brass Company, of New York, for one year and came to the Coe Brass Company, of Torrington, in 1904 as accountant. The latter company had shortly before been acquired by the American Brass Company. He was officially appointed accountant of the American Brass Company in 1916 and was elected assistant treasurer of the company in 1920. He has been appointed a member of the board of finance of the city of Waterbury, effective January 1.

Mr. Judge's portrait was not obtainable at this time.

Obituaries

EDWIN THAYER PETERS

Edwin Thayer Peters, whose death was noted in our October issue, was the son of Mary Huxley and Edwin Peters. He was born in Birmingham, England, August 8th, 1873, and came to this country as a boy, starting his apprenticeship in the casting shop of the American Brass Company at Ansonia, Conn., at the age of 16 years. He was with the American Brass Company for eighteen years, leaving them to enter the employ of the National Conduit & Cable Company at Hastings-on-Hudson, New York, where he worked for nine years. Mr. Peters was employed by the Stamford Rolling Mills Company of Stamford and Springdale, Conn., in 1915, as casting shop superintendent of both mills of that company, which position he held at the time of his sudden death on August 20th, 1925.

EDWIN THAYER PETERS

Mr. Peters was a man of genial disposition, with many friends in the brass industry.

Mr. Peters was an expert in his trade and was considered one of the best brass casters in the country. He was a member of Derby, Conn., Lodge of Elks and a Mason. He leaves a widow and one son.

PAUL R. HENDERSON

Paul R. Henderson, general supervisor of the Aluminum Cooking Utensil Company in Chicago, Ill., was instantly killed in December, 1925, when he leaped from the Liberty Limited train while passing through Massillon, Ohio. Mr. Henderson, who was 33 years old and lived at 6604 Kimbark Avenue, was said to be suffering from a mental derangement, and was in the care of a male nurse and guard.

GEORGE F. OTT

George F. Ott, 84 years old, one of the pioneer boiler manufacturers of the East, died at his home in Philadelphia, Pa., Sunday, December 6, 1925. Mr. Ott was head of the George F .Ott Company, which for nearly half a century has specialized in the manufacture of copper and iron boiler work, principally for breweries.

EZRA W. SCOTT

Ezra W. Scott, 60, foundry foreman with the Bunting Brass and Bronze Company, Toledo, Ohio, died suddenly recently when stricken with a heart attack while at work in the Spencer Street plant. Mr. Scott lived at 682 Walbridge Avenue.

DR. KARL GOLDSCHMIDT

As we go to press, announcement comes of the death of Dr. Karl Goldschmidt, of Essen, Germany on January 4, 1926. A more complete notice will be published in our February issue.

NEWS OF THE INDUSTRY

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS

NEW ENGLAND STATES

WATERBURY, CONN.

JANUARY 4, 1926.

The year, just closed, has been a prosperous one for local factoris. There has been practically no short time throughout the year except for about four weeks in the summer when a few hours were cut off the working schedule. There has been practically no unemployment and almost anyone who wanted work could find it. The number employed in the local factories has shown a steady increase since the first of the year.

In fact, business is so good now that there is serious talk of establishing a nine-hour day but working 10 hours and paying time and a half for over 9 hours. During the war and for a year after, the eight-hour day was established in local factories, but with practically all working 10 hours and being paid time and a half for over 8 hours. This was done away with and wages based on a flat 10 hour day when the depression set in. Whether the nine hour day will be established soon or not is problematical but it is known that it is being considered.

There has been a large amount of factory construction during the year, in fact, more new buildings have been put up than in any year since the war. Among the larger buildings put up are: a five-story factory building of the **Patent Button Company,** the largest factory building built in the city since the war; a new tube mill of the **A. H. Wells & Sons Company,** and a four-story factory building of the **French Manufacturing Company.**

The annual election of officers of the **American Brass Company** occurs early in February. Since its absorption by the

Anaconda Copper Mining Company there have been few changes among the officers, most of the officials being re-elected each year. The only changes were the dropping of three former vice-presidents, **John P. Elton, George W. Burnham** and **Thomas Kent,** and adding to the directorate **Cornelius F. Kelly, John D. Ryan** and **Benjamin B. Thayer,** representing the Anaconda company. The present officers are: Chairman of the board, **Charles F. Brooker;** president, **John A. Coe;** vice-president, **E. L. Frisbie;** secretary, **Edward H. Yates;** treasurer, **C.L. Hollister,** and assistant treasurer, **Major W. Judge.** There have been rumors that possibly some changes may be made at the coming meeting, but it has been impossible to confirm them. Mr. Brooker has been with the company for over 60 years and Mr. Frisbie has been in the brass business considerably over 50 years, but whether or not they are planning to retire at this time is not known.

Fire totally destroyed the plant of the **Rasmussen Manufacturing Company** in the Town Plot section, early last month. The plant, a small one devoted to the manufacture of small brass articles, and the machining, buffing and lacquering of brass ware for the larger local factories, consisted of two factory buildings. Both were burned to the ground and the loss is estimated at close to $100,000. Three fire companies were called out but were unable to save either structure. The plant was started and built up by **Hans Rasmussen** and his sons.

It is expected that the sales of the **American Brass Company** for the present year will show an increase of 25 per cent over the total for 1924 with a corresponding favorable gain in the net earnings. Due to this increase it is confidently predicted in responsible quarters that the dividend rate of the Anaconda company will be increased from $3 to $4 a year.

Prof. W. H. Bristol, head of the Bristol company, has perfected a method of synchronizing motion pictures and phonographs so as to produce "talking pictures." He has given several demonstrations of his method at his studio at the Bristol company to educators and business men of the surrounding towns. With the collaboration of **Dr. Raymond Lee Ditmars,** curator of the New York Zoological Society, he has prepared a series of speaking moving pictures on natural history which it is expected will be used in schools about the country.

Hugh L. Thompson, local consulting engineer, and connected with several of the large industries of the city, has been elected by the American Society of Mechanical Engineers as a delegate to the American Engineering Council for the period, 1926-1927.

Plans have been completed for the memorial to the Pilgrim Fathers, funds for which were provided by the late **Charles G. Harrub,** throughout his life engineer for the American Brass Company. He left $125,000, amounting to practically his entire life savings to be used for the building of the memorial mentioned which is also to be in memory of his wife. The memorial will face the proposed new bridge across the Naugatuck River now building and will be in harmony with it.

A research article on brass prepared for the Engineering Foundation by **William G. Schneider,** member of the American Institute of Mining and Metallurgical Engineers, tells of the part played by Waterbury in the early manufacture of brass, stating that the industry in this country was practically begun in Waterbury with the brass foundry of **John Allen** in 1750. Invention of the process of brass spinning by **H. W. Hayden** in Waterbury in 1851 is called the first real forward step contributed by America in brass making.

The basketball team representing the **Scovill Manufacturing Company** has won the championship of the local Industrial League.

Major W. Judge, assistant treasurer of the American Brass Company, has been appointed by Mayor F. P. Guilfoile, a member of the city board of finance, beginning January 1, 1926.—W. R. B.

BRIDGEPORT, CONN.

JANUARY 4, 1926.

Industrial conditions in Bridgeport, according to the leaders in the metal trades and other lines, have shown the best improvement during 1925 of any year since the depression that followed the war. Since the first of the year, volume of business and the number of men employed has shown a steady rise throughout the year with the exception of a few weeks during the summer.

Due to the efforts of the Chamber of Commerce and local industrial organizations a large number of small businesses have been induced to locate here so that now the greater part of the factory buildings were vacated by concerns which went under during the post-war depression have now been filled with industries that are employing help and turning out goods. There appears to be no reason to doubt that industrial conditions will continue to improve gradually during the next year. At least, there are no conditions in prospect that would indicate that any of the ground gained will be lost for many months to come.

Prosperity of Bridgeport during the year is indicated in the fact that many of the firms gave Christmas bonuses to their employes the last part of last month. The **Crane Company** was the first, giving a bonus amounting to five per cent of their yearly wages to each of their employes. The bonus will be paid in gold and silver, amounting, it is said, to nearly a quarter of a ton.

C. V. Barrington, vice-president of the **Jenkins Brothers Company,** announced that his company had followed suit by also giving its employes a bonus in bonds amounting to five per cent of their yearly earnings. There are 600 employes of the company who received over $50,000 in bonuses. Employes who left the firm during the year because of illness will receive five per cent of their earnings up to the date on which they left.

By an order signed by Judge Edwin S. Thomas of the United States District Court of Connecticut, an action of the **American Chain Company** of this city against the **Bullard Machine Company** of this city, in which damages were claimed for alleged infringement on a certain automobile bumper, has been discontinued "without prejudice." The suit had been prepared for trial and had been in abeyance for some time due to the fact that the American Chain Company had a similar suit in the federal courts in California against the Lyon Company of New York, where the United States District Court found for the American Chain Company. Recently, the United States District Court reversed the decision of the lower court. Pending the outcome of that suit, the litigation here remained dormant.

A fire badly injured the plant of the **Kilborn & Sauer Company,** metal goods manufacturers in Fairfield, last month. Damage of about $20,000 was done. The fire originated in a short circuit in the japanning tank and spread rapidly through the building. The building was saved from entire destruction by the quick arrival of the firemen. **Henry Sauer,** treasurer of the company, stated the plant will be rebuilt.

George S. Hawley was reelected president of the Manufacturers' Association of Bridgeport at the annual meeting, January 6. The other officers elected are: Vice-presidents, Sumner Simpson and W. Stewart Clark; treasurer, Dwight C. Wheeler; executive board, E. P. Bullard, W. C. Bryant, L. A. Nothnagle, H. B. Houghton, William F. Hobbs, H. B. Strong, H. R. Beach, J. R. Wrigley, L. R. Edwards and H. C. Ives. Mr. Hawley and John E. Daniels, legislative secretary of the Associated Industries of Massachusetts, were the principal speakers at the dinner which followed the election at the Stratfield.—W. R. B.

TORRINGTON

JANUARY 4, 1926.

The metal industries of Torrington experienced a remarkably good year in 1925 and the outlook for 1926 is most promising. For the first time since war days many of the plants have orders booked for as far as three months ahead. In fact in practically every plant the orders are coming in faster than they can be filled.

"The outlook is good—remarkably good," was the comment of one of the leading manufacturers in Torrington in discussing the situation with a representative of THE METAL INDUSTRY several days ago.

At the outset of 1925 business was just beginning to pick up Conditions steadily improved during the first half of the

year and by early fall a period of real prosperity had definitely arrived. There were some pessimists who feared that the coal strike would seriously affect the situation but this has not been the case. The last quarter of 1925 established new post-war records in all the metal plants. Even the December falling off, which always is expected, did not materialize, and there were no shutdowns except over Christmas day and the Saturday following.

Some of the plants already are working overtime and the schedules probably will have to be further lengthened before the new year is very far advanced. There is plenty of work for the skilled men—in fact for all divisions of labor, though the releasing of the road workers for indoor employment temporarily over-supplied the demand for common laborers. This over-supply has been absorbed in the past month, however, and almost nobody is now out of work. There will be no recession of wages. In every plant there has been expansion of the piece-work basis, affording the worker increased opportunity to enlarge his earnings, bonuses being offered in addition to the regular pay.

Work has been started on another brick addition to the Hotchkiss **Brothers** plant. This concern at Christmas gave each of its employes a Christmas bonus of four per cent of his annual pay in addition to the regular pay.—J. H. T.

NEW BRITAIN, CONN.

JANUARY 4, 1926.

Reviewing briefly the 1925 industrial period in New Britain, one finds that the various metal manufacturing concerns here had practically no disturbing periods of depression, business was maintained at an average and in some cases a little better than average quantity, there was no labor trouble, unemployment was nil and profits were good. This last fact was no better demonstrated than by the several extra dividends declared during the holiday season. In forecasting for 1926, leaders in the various industries here profess to see no reason why business should not continue as it is. No labor troubles threaten. There is evidently a continued demand for New Britain made hardware. The steel output here is not up to the demand and orders still are ahead of production.

The **Stanley Works,** which recently has completed a gigantic water power plant, are further expanding and announce plans for the building of a factory branch in Belgium to handle that part of its foreign trade. The steel mill department is steadily growing and to handle the work plans for a new building for gauging rolls and annealing furnaces have been turned over to a Boston firm. The structures will be of concrete and structural steel, of the monitor type, 110 feet wide and 250 feet long. The second building is an addition to the machine shop. The total cost is about $90,000.

Landers, Frary & Clark, the **American Hardware Corporation,** in all its departments and other local concerns are maintaining a good output and their outlook for 1926 is good.

In the neighboring city of Bristol, where is located the **New Departure Branch** of the **General Motors,** business likewise is excellent. The New Departure Company now is turning out about 95,000 bearings a day and additions to the plant are constantly being made. The addition of about a half hundred automatic machines, the product of the New Britain Machine Company, has increased production materially.—H. R. J.

PROVIDENCE, R. I.

JANUARY 4, 1926.

The volume of business in all lines of the metal trades showed an improvement during 1925 and the new year dawns upon encouraging prospects for continued improvement in 1926. Reports from the various branches of the metal industry bear out this situation, although some indications are more satisfactory than others. Yet, all are prophetic of betterment. This is especially true in regard to the manufacturing jewelry and structural trades, the former giving promise of the best business since before the World War. It is conservatively estimated that there are from a third to a half more persons employed in the jewelry industry and its co-ordinate branches at the present time than there were at the beginning of 1925, while the volume of business for the year far exceeds that for several years previously.

A record breaking condition in the building situation the latter part of the old year has kept the structural lines busy, and there is every indication that this condition will improve, rather than decrease. A most encouraging phase of this situation is the increasing use of metal frontal ornamentations, etc., on buildings, especially the large business structures of which a number are now in process of erection or contemplation. In consequence, the sheet metal workers are approaching capacity for the first time in many months and new men are gradually being added by many of the firms.

The small tool-making concerns show the least change in conditions as compared with a year ago, but while few exhibit any decided improvement, few claim to have fallen behind to any great extent. As a result the managements of the various concerns continue optimistic. There is undoubtedly good reason for this, for which the improvement in the general lines, the demand for tools and small machinery must necessarily show an increase in due time.

Announcement was made early the past month of the successful reorganization of the metal products manufacturing business formerly conducted by the **Frank Mossberg Company** at Attleboro. The concern became involved in financial difficulties in 1924 and in June of this year the plant was sold at public auction by a stockholders' committee. The operating position of the concern is stated as being strong, an operating profit of approximately $55,000 having been realized under the receivership which has been in effect about a year Employment of about 200 mechanics is anticipated and plans are well developed for the promotion of the different branches of the business. The officers of the new corporation are as follows: President, L. R. Smith of Attleboro; senior vice-president, J. M. Washington; vice-president, L. B. Smith; secretary and treasurer, A. A. Underwood; assistant treasurer, S. Jones; directors, A. S. Ingraham, E. F. Thayer and L. R. Smith of Attleboro; F. J. Kandt of New York, A. T. Hopkins of Boston.

Charles E. Hansen of the **Platinide Company,** of this city, has recently been granted a patent on a new white gold. Mr. Hansen is the metallurgist and treasurer of the Platinide Company.—W. H. M.

MIDDLE ATLANTIC STATES

ROME, N. Y.

JANUARY 4, 1926.

The Copper City enjoyed its gretest industrial prosperity during 1925, due to the record-breaking business of the brass and copper industries here. More than 6,500 peaple are employed in those industries in this city and at a total in wages that exceed even those paid during the World War. Night shifts in many departments are working and have been for some time, and still the orders cannot be cleared up.

The **Rome Wire Company** is completing one of the finest office buildings in Central New York, and the building operations under way will include a big addition to the mill itself. Mill extension of this kind during 1925 may prove insufficient to meet the heavy business in prospect and there is considerable likelihood of still greater building extensions during 1926. In fact, it is more than a rumor that plans for extensions are practically perfected.

Every plant engaged in working in brass and copper in this city is growing, and employing more hands than ever before. This is one of the reasons that the Copper City has and is enjoying unusual business prosperity. Nearly 5,000 more people now live here than did when the 1920 census was taken, Rome now having more than 30,000 population. A recent survey of the city showed only 22 flats or family living apartments vacant, while living accommodations for more than 200 families were desired, the mills of the city wanting to bring that number of additional families here. Although more than 100 new houses were built in Rome in 1925 many more are needed, and it is expected that at least 250 more will be erected in 1926.

The necessity for these new houses is brought about chiefly

by the big business of the brass and copper working companies of the Copper City.

Orders booked for the first three months in 1926 indicate that the big business which has made 1925 such a banner year here is to be continued, at least the same high speed, if not more.—W. P. D.

ROCHESTER, N. Y.

JANUARY 4, 1926.

Despite the fact that business among the metal-using industries was somewhat irregular, the year as a whole showed much improvement over 1924. Total production was much larger, month by month, and metal workers were employed practically all of the period at wages that were satisfactory in the main. There were brief seasons of quietude, but all in all 1925 proved to be a good year in the metal trades.

A feature is the unexpected rush of business during the month of December. Since late in November nearly every plant employing metals has been operated to the limit. In particular this is true at the brass foundries, aluminum works, and electro-plating plants about the city. In all of the larger manufacturing plants, brass molding shops and plating departments have been pushed to the utmost.

The bulk of the rush work now enjoyed by the brass foundries is of a local character, and it was said today that not a brass worker or moulder was idle in Rochester. The silver plating industry is quieting down, after a fairly active season preceding the holidays.

Manufacturers who can be induced to discuss prospects are very optimistic as to the business outlook for 1926. In such plants as the **General Railway Signal Company, Eastman Kodak Company, Bausch & Lomb Optical Company, Todd Protectograph Company** and **Taylor Instrument Company,** continued high operations are anticipated for several months ahead. This is particularly true in the case of the Signal Company, which has a number of large railway signal equipment orders that will keep the plant very busy until spring at least.

Activities among the can companies are quiet just now, but it is expected that business will improve in this direction early in the new year. **Yawman & Erbe** have had a good year and are very optimistic as regards 1926.—G. B. E.

TRENTON, N. J.

JANUARY 4, 1926.

Trenton metal industries experienced a good year and while there were times when business was a little slack the difference was made up in the other months. Both the **Jordan L. Mott Company** and the **John A. Roebling Sons Company** report a good increase in the volume of business during the last few months. Manufacturers are looking forward to a good spring and summer trade in all their lines.

The **Kelso Radio, Inc.**, of this city, has been incorporated with 1,500 shares of preferred stock and 1,000 shares of common stock to manufacture radio supplies. The incorporators are J. Russell Kelso, Sr., J. Russell Kelso, Jr., and Herbert B. Frost.

The plant of the **New Brunswick Lamp & Bronze Company,** which has been idle for some time, has been purchased by the Middlesex Box Company.

The receivership ordered by the Court of Chancery in October for the **Trenton Patent Manufacturing Company,** of this city, was ended when Vive Chancellor Buchanan transferred the machinery, patents and other assets of that company to the **William H. Jaeger Products Company,** also of Trenton. The transfer was made upon the recommendation of John W. Foster, receiver for the defunct company. The plant will be opened and the manufacture of pistons and rings resumed. The officers are: William Jaeger, president; Adolph G. Miller, secretary and treasurer.

Articles of incorporation have been filed by the **Princeton Radio Company,** of 118 Factory street, Trenton, N. J. The company starts with $10,000 capital and the incorporators are Albert Harrison, Ira Alexander and Charles T. Lore. The company will manufacture radio supplies.

Following concerns were incorporated here during the month: **Thomas Supply Company, Inc.,** hardware, Camden, N. J., $100,000; **Metals Disintegrating Company, Inc.,** minerals, Elizabeth, N. J., no par; **Passaic Iron & Metal Company, Passaic,** N. J., irons and metals, $100,000; **Chemical Refining Corporation,** Matawan, N. J., chemicals, $50,000; **General Sheet Metal Works,** Newark, N. J., sheet metal, $125,000; **Useful Metals Corporation,** Toms River, N. J., metal products, $150,000; **Electrical Appliance Corporation,** Newark, N. J., electrical appliances, $50,000; **Central Chemical Company,** Newark, N. J., manufacture chemicals, 2,000 shares no par; **K. & H. Electrical Corporation,** Newark, N. J., electrical fixtures, $125,000; **Robert C. White Company,** Camden, N. J., chemicals, $100,000.—C. A. L.

PITTSBURGH, PA.

JANUARY 4, 1926.

The metal industry in Pittsburgh and throughout Western Pennsylvania experienced a healthy touch during the closing period of the year. During the first six months of the year business was slow in some of these lines but a good improvement was made the last month and the close of the year shows an optimistic view of the district's present and future.

Employment conditions are good and major industries are operating on satisfactory schedules. Aluminum, brass, electroplaters, metal and plating trades; machinery car building, locomotive and railway equipment industries are increasing production. Electrical industries are operating at capacity.

Electrical manufacturers report large orders booked in advance. Some of the features in this industry are the demand for generating equipment, and the purchasing of ten electric locomotives for the New York Central Railroad. Orders for hydro-electric equipment, valued at more than $1,000,000 were placed. Industrial plants have been buying steadily.

The jewelry trade showed considerable more activity during November and December on account of holiday purchasing, both retail and wholesale.

In Pittsburgh and in certain other portions of the country there are men engaged in the serious occupation of finding some substitute for the tin can. The difficulty lies in the tin itself, which is used to provide the coating for the steel that forms the body of the can. Tin has become an expensive metal.

Expressions reseived here unofficially from the leading can companies are that they expect their business to be just as good next year as 1925, which will be shown to be a record year for them.—H. W. R.

MIDDLE WESTERN STATES

DETROIT, MICH.

JANUARY 4, 1926.

The brass, copper, aluminum and grey iron industry in Detroit and its suburbs is starting one of the most promising years of its history. For twelve straight months only vigorous operations have been the rule. Optimism is expressed on all sides. It is believed by the heads of most of the large plants here that a long run of unbroken prosperity is in prospect. It is difficult to refer to the metal industry in Detroit without taking into consideration the automobile industry, because both are so closely related that the prosperity of one is the prosperity of the other. The motor car plants are all operating to capacity and are planning for strenuous production during an indefinite period. It is apparent at present that still further price reduction is coming which will further increase the buying of cars and add to demands on both the motor and metal plants.

The Detroit Board of Commerce has recently printed a roster of its active membership and among those concerns are the following: American Brass & Iron Company, American Injector Company, Bohn Aluminum & Brass Corporation, Capital Brass Works, Crescent Brass & Pin Company, Detroit Copper & Brass Rolling Mills, Hunter & Wilkie, McRae & Roberts Company, Michigan Copper & Brass Company, Pemberthy Injector Company, Roberts Brass & Manufacturing

Company, Sherwood Brass Works, Standard Peninsular Brass Works, Unique Brass Manufacturing Company, United States Aluminum Company, Wolverine Tube Company.

George **H. Barbour,** chairman of the board of the **Michigan** Stove **Company,** has announced the merger of that organization with the **Detroit Stove Works,** two of the largest makers of heating and cooking equipment in the world. The new concern will be known as the **Detroit-Michigan Stove Company.** It will have a capitalization of $3,000,000 in par value preferred stock and 1,100,000 shares of common of no par value. The new company will have approximately 2,400 employes and occupy about 35 acres of factory space. This amalgamation gives Detroit the largest single industry of the kind in the world. The annual value of the product is estimated at approximately $10,000,000.

The **National Manufacturer & Plating Company** has recently been incorporated in Detroit with a capital stock of $10,000. It will engage in a manufacturing and plating business. The owners are Fred W. Beyer, Elinore Jacklin and Joseph H. Jacklin, 1633 W. Grand Boulevard, Detroit.

Plans for the Second International Foundry Congress and the thirtieth annual convention of the American Foundrymen's Association, to be held simultaneously in Detroit next September, are already being made by Detroit foundrymen. Between 5,000 and 6,000 American and Canadian foundrymen and 150 to 200 experts of the industry in practically every foreign country will be present at this big meeting, it is the expectation of C. E. Hoyt of Chicago, secretary and treasurer of the organization who was in Detroit recently. "It will be the greatest meeting this industry has ever had," he says, "and Detroit was chosen because of the educational advantages it offers as the premier foundry city of America."—F. J. H.

CHICAGO, ILL.

JANUARY 4, 1926.

In the recent "stock taking" feat performed by the Chicago Association of Commerce on the occasion of its twenty-first birthday, the metal trades, it was revealed, have made notable progress. This within the last twenty-one years. In the Chicago district the entire group of metals during the decade from 1914 to 1924, increased 342 per cent and hardware 262 per cent. Leaders are congratulating themselves on this showing which so indubitably registers the general condition of commerce in the Chicago district, as the metal industry has always been considered the barometer of business.

A fact brought out by the commerce association's servey is the claim of Chicago, interesting to the metal trades, that this city is the biggest distribution center for hardware in the Unted States. Builders' hardware, mechanics, and agricultural tools, guns, cutlery, sporting goods, household utensils, and so forth are distributed here in constantly increasing quantities. Stocks maintained here are the most complete in the country.

The toy industry, demanding much metal, is significantly growing, the survey shows. Some 75 establishments are located in the metropolitan area, while the city proper has twenty-four factories whose output in 1923 was $3,198,211. At jobbers' prices, the products of all the factories in the area is estimated at close to $6,000,000. The largest toy train factory in the world is located here and reports that since 1914 the business increased 1,500 per cent.

The **Maremont Manufacturing Company,** 916 S. Wabash avenue, Chicago, manufacturing auto bodies and springs, are receiving bids for the construction of a two-story factory and office building on Ashland avenue, Chicago. It will run 265 feet frontage between 16th and 17th streets. The structure will be of reinforced concrete with pressed brick and stone front and the estimated cost is placed between $200,000 and $250,000.

Bell & Howell Company, manufacturers of moving picture machines and projectors, are receiving through the architects, Pond & Pond, bids on a six-story addition, 200 x 200 feet, on its plant at 1803 Larchmont avenue, near Ravenswood avenue, Chicago. The cost is estimated at $300,000.

The **Illinois Nail Company,** 826 Dix street, Chicago, of which J. B. Sherlock is president, has awarded a contract, through Paul Gehrhart, architect, for a one- and two-story warehouse building, 100 x 160 feet, to be erected at 823 Lessing street. The cost has not been made public.

The **Sprayola Manufacturing Company,** 133 W. Washington street, have recently been incorporated. They will manufacture cleaning apparatus, appliances. Robert D. Steele, William H. Craig and C. B. Craig are the incorporators, while Holberg, Hummel & Winans, 10 S. La Salle street, are the correspondents.

Millen, McCurdy Ludlow Company, 2025 S. Michigan avenue, has been incorprated with a capital stock of $10,000. They will manufacture and deal in articles used for building hardware and fittings of all kinds. The incorporators are R. C. Millen, O. A. Ludlow and U. B. McCurdy. Correspondent, Hans Vonreinsperg.—L. H. G.

OTHER COUNTRIES

BIRMINGHAM, ENGLAND

DECEMBER 21, 1925.

The makers of copper sheets have this week reduced their prices by £2 per ton, making the selling figure £90, and the tube makers have reduced their price ¼d a pound, making the basis 1s 1d. The reduction is chiefly due to the lower price of copper. The works are fairly engaged, but could handle much larger tonnages. Foreign competition is not serious, except in brass wire, for which Germany is a keen competitor, especially with India. A large Indian order was in the market recently, and the Birmingham makers realizing the keenness of foreign competition quoted a figure which covered merely the cost of wages and material, but they found themselves under quoted by £4 per ton. The brass wire trade has scacely been worth handling of late.

The increased activity in illuminating brass work which usually arises at this season is being met with by Birmingham makers. The designs and patterns are continually being improved, generally in the artistic direction, and America continues one of the best markets for this class of Birmingham manufacture.

There is great disappointment among the makers of aluminum good at the refusal of the Government to entertain their application for the imposition of a tariff under the Safeguarding of Industries Act. The British market has been flooded with German products of light construction with which the British makers find it difficult to compete. It is stated that in many cases these articles could be met in regard to quality and price, but the makers are very reluctant to reduce the level of quality, preferring to make a sound and fairly substantial article.

The increasing activity in most branches of the brass trade has further reduced the number on the unemployed list. Although there are still large numbers out of work, the scarcity of skilled metal workers is becoming a most serious problem. The men's trade union co-operates with the employers in filling vacancies, but lately this has been almost impossible, as regards brass casters and fully skilled finishers. The scarcity of labor is largely due to the smaller number of youths entering the trade, and employers and the leaders among the men are discussing schemes with the object of promoting the training of skilled artisans, somewhat on the lines followed by the gun trade, which, for many years, has had its gun school, where the youths receive practical tuition in the evenings in all branches of gunmaking, with the encouragement of gun manufacturers, offering more or less substantial prizes. The brass trades are suffering to some extent through the transfer of numerous workers into various branches of the motor and cycle industries, especially in the factories where accessories are produced. In numerous instances workmen clever in the handling of tools have migrated from the jewelry and other metal trades into motor and allied industries.

The jewelry trade is finding the customary autumn activity, business being fairly brisk, with a considerable amount of overtime. The electroplate trade is getting a share of this activity but is suffering a good deal from the slump in shipbuilding and shipping generally.—J. H.

Business Items—Verified

The **American Graining Plate Company,** 111 West Harrison street, Chicago, Ill., is in the market for sheet brass flat, over 14 in. wide 12 gauge.

I. Noyck has taken over the Englewood Plating Works, at 672 West 63rd street, Chicago, Ill., specializing in copper and nickel plating, on stoves and automobile parts.

Service Plating Works are now located at 230 Clinton street, Chicago, Ill., where they will make a specialty of contract plating and general line of nickel and copper plating.

F. Hilding has opened a shop at 2036 West North avenue, Chicago, Ill., to do scroll sawing in brass copper and aluminum, as well as metal inlay for musical instruments.

The **Santry Manufacturing Company** has moved to 2036 West North avenue, Chicago, Ill. This concern manufactures specialties in aluminum and does experimental work for the trade.

The **Cincinnati Electric Tool Company,** 1501 Freeman avenue, Cincinnati, Ohio, is moving into larger quarters, in the plant of the R. K. LeBlond Machine Tool Company, Cincinnati.

The **Western Plating Company** has taken the lower part of 2004 West Lake street, Chicago, Ill. This firm does plating for the trade in nickel, copper, brass, and is installing a silver department.

The **Electro Refractories Corporation,** 70 Ohio street, Buffalo, N. Y., has moved its accounting department from Ellicott Square to its factory in Kellogg, N. Y., and its sales office to 70 Ohio street.

The **Crescent Plating Works** are now located in the new building 4108 N. Kedzie avenue, Chicago, Ill. This concern does nickel and copper plating, making a specialty of auto and stove parts.

A. Borta & Sons now occupy the entire lower part of 2235 Indiana avenue, Chicago, Ill., specializing in nickel plating on automobile parts. They operate the following departments: plating, polishing, lacquering.

The **Guyan Machine Shops,** Lowan, W. Va., machinery dealers, have inquiries out for ovens, about 48 x 60 in., and 7 ft. long, for use with natural gas fuel to a temperature of 200 deg. F., for baking armatures.

The **Norton Company,** of Worcester, Mass., has opened a branch office and salesroom at 338 Third avenue, Pittsburgh, Pa. A stock of grinding wheels will be carried. Ralph O. Anderson continues as district manager.

Northwest Steel & Metal Products Company, Seattle, Wash., will soon break ground for a new plant on the Lake Union Canal, to cost $250,000, with machinery. Abraham Goldberg is president. This firm operates a rolling mill.

The **Lapeer Trailer Corporation,** manufacturers of Automatic Semi-Trailers, announces the appointment of J. B. Beattie as eastern sales manager, with headquarters in New York City. Mr. Beattie was formerly connected with the Autocar Company.

The **Brighton Nickel Works,** formerly of 2157 Clybourn avenue, Chicago, Ill., have taken the entire building at 1349 Webster avenue. This concern specializes in nickel plating and operates the following departments: plating, polishing, lacquering.

The **New England Smelting Company,** Union and Day streets, West Springfield, Mass., has awarded contract for extensive plant alterations. Isaac Brown is president. This firm operates the following departments: smelting and refining; aluminum foundry.

The **General Electric Company,** Philadelphia, Pa., asked bids on a general contract for a one-story addition to its plant at 68th and Glenmore streets, 28 x 250 ft., to be equipped as a galvanizing works, but has changed its plans regarding this building and will not proceed with it.

The **Dole Valve Company,** 1923 Carroll avenue, Chicago, Ill., will soon ask bids for building, 3-story, 125 x 125 ft., to cost $75,000. A. R. Dole is head. This firm operates the following departments: brass, bronze foundry; brass machine shop, tool room, plating, soldering, polishing.

John P. Herwig & Son, 6054 Broadway, Chicago, Ill., are planning to increase greatly their silver plating department. This concern manufactures electrical goods, and does job plating in nicked brass and copper, as well as silver. They operate plating, polishing and lacquering departments.

The **Hermosa Brass & Plating Works,** 1859 North avenue, Chicago, Ill., have opened a retail store on the ground floor of their present building, for the sale of hardware specialties and electrical goods. They specialize in electro plaster plating, as well as a general job plating line in all metals.

The **Fred W. Gehrer Company,** metal spinners of 3264-3270 West Grand avenue, Chicago, Ill., report an increase of 100 per cent in business the past year. They are installing several additional lathes for the exclusive spinning of aluminum. They are spinners in all metal, specializing in aluminum and Monel metal.

The **White Metal Products Company, Inc.,** 546 W. Jackson Boulevard, Chicago, Ill., has added a department for designing, modeling and mold making, as well as the manufacture of white metal castings of every description. This firm operates the following departments: casting, tool room, plating, lacquering, polishing.

Fuhrman and Lundberg, are now located at 1352 So. Canal street, Chicago, Ill., where they have much better and larger quarters. They now handle a stock of sheet aluminum, in addition to anodes of all descriptions and are always in the market to buy nickel coated scrap brass and copper plating racks and hooks.

The **Grand Metal Spinning Company,** manufacturer of scientific laboratory apparatus, has opened a shop at 433 So. Western avenue, Chicago, Ill., for spinning in all metals, as well as stamping brazing and polishing for the trade. The following departments are operated: spinning, stamping, brazing, polishing, plating.

The **Wellman Bronze Company,** 6017 Superior avenue, Cleveland, Ohio, has placed contract with the H. G. Slatmyer & Son Company for a two-story, 53 x 60 ft. addition to its foundries. Fred S. Wellman is president. This firm operates the following departments: brass, bronze and aluminum foundry; brass machine shop, casting shop, plating.

The **Milwaukee Die Casting Company,** 295-297 Fourth street, Milwaukee, Wis., has acquired adjacent property, 50 x 150 ft. for $40,000. H. F. Schroeder is vice-president and general manager. This firm operates the following departments: smelting and refining; brass, bronze foundry; aluminum die casting plant; brass machine shop, tool room, casting shop.

An announcement has been made by the **Oxweld Acetylene Company,** 30 East 42nd street, New York City, of the appointment of J. N. Walker as general sales manager. L. D. Burnett has been appointed Eastern Department sales manager, to succeed Mr. Walker, and Z. T. Davis, Jr., is now filling Mr. Burnett's former assignment as assistant sales manager, Eastern Department.

Jenkins Manufacturing Company, 35 Farrand street, Bloomfield, N. J., manufacturer of red brass fittings, will build a one-story foundry addition and an electric furnace equipment to increase capacity materially. This firm operates the following departments: bronze and aluminum foundry; brass machine shop, tool room, plating, japanning, stamping, soldering, polishing, lacquering.

Suburban Bronze and Iron Corporation, Atlantic avenue and 107th street, Richmond Hill, N. Y., has been organzed, to do bronze and iron work of all descriptions for office buildings, hotels and banks, and other miscellaneous work such as stairs, railings, gratings, ladders, gates, saddles, window guards, grille, etc. The plant is built, and manufacturing will be by contract. The company will be in the market for materials.

Jackson Valve & Manufacturing Company, Inc., 1106-15th street, Portsmouth, Ohio, manufacturer of high pressure steam valves, will build a foundry and machine shop to produce and finish its own castings. This firm is in the market for a very small vertical surface grinder, capable of grinding terret lathe plate cutters. The following departments are operated: brass, bronze and aluminum foundry, casting shop, cutting-up shop, stamping.

Equitherm Engineering Corporation, 8-10 Bridge street, New York, announces the acquisition of all assets, patents

and good will of the Equitherm Control Corporation of 13 Tillary street, Brooklyn, N. Y., as of September 18, 1925, and the continuance of the latter's business in the manufacture of patented industrial electrically operated temperature controls, automatic fire alarm and signal systems and kindred apparatus including electrically operated valves, etc.

Smith & Hemenway Company, Inc., Irvington, N. J., manufacturers of "Red Devil" tools announce the retirement of J. F. Hemenway. His entire interests have been purchased by Landon P. Smith, president. Mr. Smith will continue in the active management of the business as heretofore. Several new developments are in the course of preparation, such as re-designing of buildings and improving machinery to better facilitate the manufacture of "Red Devil" tools.

Dr. Robert J. Anderson, consulting metallurgical engineer, has just been appointed district manager of F. J. Ryan & Company, industrial heating engineers of Philadelphia, Pa., and will represent that company in Cleveland and the Ohio district and surrounding territory. F. J. Ryan & Company are manufacturers of electric and fuel-fired furnaces, combustion and temperature control systems, oil and gas burners, core and mold ovens, and other industrial heating equipment.

The **Kirkwood Manufacturing Company,** Preston, Ont., Canada, has taken over the plant and equipment of the Electrical Fittings and Foundry Company, local, and is equipping it for the manufacture of electric conduit fittings, drawn steel switches and outlet boxes, ornamental lighting fixtures, etc. This firm operates the following departments: brass, bronze and aluminum foundry; tool room, grinding room, casting shop, galvanizing, plating, japanning, stamping, polishing, lacquering.

The **Burns Brass Foundry,** Battle Creek, Mich., has erected a new factory building and adapted the commercial garage type of construction to molding room needs, of brick and steel, except for cement floor and self supporting frame roof with fire resistant roofing. The building is 40 x 64, and is given a pleasing aspect by a stuccoed front gable with attractive sign. Wide expanse of glazed steel sash on all sides, and roof ventilators. One and one-half tons of brass, bronze and aluminum can be founded in a working day.

The **Iowa Foundry & Manufacturing Company,** Fort Dodge, Iowa, has renewed its charter and organization for a second 20-year period as the company was organized more than 20 years ago, and the old organization period had expired. The company has a foundry and a machine job shop, and manufactures concrete mixers, four styles mounted on skids, without power, and three styles mounted on trucks with or without power. The company manufactures also foundation coal chutes, farm drainage grate catsings, city sewer drainage castings, brass and aluminum castings.

Newell, Corse & McDaniel, 706 Otis Building, 810 Eighteenth street, Washington, D. C., announce the continuation of their consulting engineering business under the name given above. A Latin American Department has been established under the direction of Dr. Richard Muller, to handle hydro-electric developments, irrigation, drainage, water supply and other utility projects. The Research Service, Inc., will be operated by the above company, and will continue to handle matters pertaining to Washington representation, investigations and reports for business and trade associations.

The **General Electric Company** has announced a definite decision to purchase a site for a manufacturing establishment in the city of St. Louis. The tracts of real estate selected contain in the aggregate about 155 acres, of which all but 11 acres are within the city limits of St. Louis; the balance lies just beyond the city limits in St. Louis County. The property in general lies between the Belt Line of the Terminal Railroad Association and Goodfellow avenue. It also has a frontage on Bircher avenue. The exact date on which construction will commence has not been determined, and it will depend, of course, upon the future growth and development of the business of the General Electric Company. It has not yet been decided what character of apparatus will be manufactured in St. Louis.

ADOPT ALL-METAL AIRCRAFT

The British Air Ministry has decided to abandon the use of wooden aircraft and to develop all-metal aircraft.

In view of financial administrative difficulties, however, the transition will be gradual. The change will probably cost $20,000,000.—New York Times.

Financial News

INCORPORATIONS

Summit Brass & Bronze Company, Akron, Ohio, has been incorporated with $10,000 capital by John Zimarik, John Metzler, R. A. Huber, E. M. Patterson and Mrs. R. Patterson. This firm has a capacity of 3,000 lbs. daily. The following departments are operated: brass, bronze and aluminum foundry; brass machine shop, tool room, grinding room, cutting-up shop, electric and acetylene welding.

Harbord Island Brass Foundry, Seattle, Wash., has been incorporated with $17,500 capital by J. B. Carmichael, G. W. Davis and O. R. G. Thayer. The following departments will be operated: brass, bronze and aluminum foundry.

The **General Brass & Copper Company,** Cleveland, Ohio, has formed a new corporation for the purpose of handling new and old metals. The firm is in the market for all grades of metals in any quantity.

The **William Olderman Company,** Howard avenue and Spruce street, Bridgeport, Conn., operating a smelting and refining plant, has been incorporated under Connecticut laws with a capitalization of $50,000. In addition to its regular business, the firm proposes to engage in brass casting and the smelting of non-ferrous metals. This firm operates the following departments: smelting and refining; brass, bronze and aluminum foundry; brass machine shop, grinding room, casting shop.

Alloys Foundry Company, Detroit, Mich., has been incorporated with $75,000 capital to manufacture iron, steel and metals by R. L. Spitzley, E. O. Jakel and A. M. Thompson, 19 W. Woodbridge street. This firm operates the following departments: brass, bronze and aluminum foundry.

NEW CHROMIUM PLATING COMPANY

The Chromium Products Corporation has been formed to take over the chromium plating business of the Metal & Thermit Corporation. In connection with this, a large addition to the present installation at 92 Bishop Street, Jersey City, is being constructed.

This new installation will be completely equipped with large tanks capable of handling general articles to which plating is adapted, and special preparations are being made to handle articles of unusual length, such as pipes, tubes and bars. The installation and technical staff will be of such size that work can be handled promptly and thoroughly, and it is expected that the new equipment will be in full operation by February.

AMERICAN FOUNDRY EQUIPMENT EXPANDS

The American Foundry Equipment Company of New York has purchased the Dodge Manufacturing Corporation Plant No. 4 at Mishawaka, Ind., for the purpose of combining their Chicago, Ill., and York, Pa., factories and executive offices from New York City. The move into the new plant started January 1, 1926. With the consolidation of all activities in one plant, the following reorganization of the company has been effected.

E. A. Rich, Jr., vice-president in charge of sales; Fred Graf, formerly foundry engineer for Frank B. Chase, has been elected vice-president in charge of production, development and engineering; O. A. Pfaff continues as treasurer and also becomes comptroller; G. E. Wyatt appointed assistant sales manager and advertising manager, succeeding R. H. Kelley, who recently resigned.

Harry A. Schwartz, inventor and patentee of the Schwartz Di-

Mold Process for making castings in permanent molds, will be actively associated with the company in the technical development of this process. Charles D. Steinmeier, who has been in charge of the plant at York, Pa., will be in charge of and devote all of his time to the commercial development of the Schwartz Process Di-Mold. He was at one time foundry superintendent of Nordyke and Marmon Company, Indianapolis, Ind. James Rigby, formerly sales manager, continues with the company as Eastern District sales manager.

BRUCE PRODUCTS PURCHASE FACTORY

The Bruce Products Corporation, located at 173 E. Woodbridge street, Detroit, Michigan, has purchased a factory at Howell, Michigan, where they will manufacture their entire line of Bruko metal finishing material.

The factory is of mill steel, concrete and brick construction, with fifty thousand square feet of floor space. It is located on the Ann Arbor Railroad with two five hundred foot sidings, approaching the building on either side. The plant is equipped with a battery of three high pressure boilers and power plant for producing light and power.

Incorporated in 1920, manufacturing of metal cleaners was begun in small quarters at 425 E. Jefferson avenue. Larger quarters were necessary and in 1923 the plant was transferred to its present location, where in addition to Bruko metal cleaners they began the manufacture of buffs and polishing wheels.

Additional equipment has been added to their Buff Department which will triple its capacity of buffs and polishing wheels. In addition they are manufacturing coloring and buffing compositions. Large glass lined tanks of 100,000 pounds capacity will be used to store zinc and ammonium chloride soldering and tinning fluxes. As jobbers, they will continue handling felt wheels, rubbing felts, American and Turkish emery, and pumice stone.

Office and warehouse will be maintained in Detroit at 5073-5 Grand River avenue, which will offer quick service to local trade. Branch offices in Cleveland and Chicago will be supplied direct from its new Howell factory.

TYPEWRITER COMPANIES MERGE

Announcement was made on December 17, 1925, of a merger of two of the best known typewriter companies in America—the Corona and L. C. Smith. Both of these companies are located in Central New York and each has the reputation of making a very high grade machine, although of a non-competitive type; the L. C. Smith being a standard office typewriter and the Corona a portable.

The L. C. Smith & Brothers Typewriter Company was founded in Syracuse in 1903 while the Corona Typewriter Company was established six years later. The principal plant of the latter is at Groton, New York; but it also has a branch factory at Cortland.

This merger, which involves $12,000,000 of capital, was negotiated by the well known engineering firm of Ford, Bacon and Davis, of New York, which a little more than a year ago purchased control of the L. C. Smith Company.

METAL STOCK MARKET QUOTATIONS

	Par	Bid	Asked
Aluminum Company of America....	...	$ 60	$ 60½
American Hardware Corporation ...	$100	90½	92
Anaconda Copper	50	49½	50
Bristol Brass	25	7	9
International Nickel, com.	25	44½	45
International Nickel, pfd..........	100	97	100
International Silver, com...........	100	98	100
International Silver, pfd............	100	105	110
National Enameling & Stamping	100	37½	38½
National Lead Company, com.	100	170	171
National Lead Company, pfd.....	100	116	117
New Jersey Zinz	100	207	210
Rome Brass & Copper............	100	130	138
Scovill Manufacturing Company	...	230	235
Yale & Towne Mfg. Company, new.	...	62	64

Corrected by J. K. Rice, Jr., Co., 36 Wall street, New York.

Review of the Wrought Metal Business

Written for The Metal Industry by J. J. WHITEHEAD, President of the Whitehead Metal Products Company of New York, Inc.

The year just closed was from many angles the most satisfactory which the metal industry has had since the war. As a matter of fact, from a number of the mills there are reports to the effect that the outputs in the months of October and November were larger than any war months, and hung up a new record.

At the end of the year most of the mills were plentifully supplied with orders and are getting off to a good start for the new year.

The huge expansion in the business of the brass and copper mills during 1925, and especially during the latter half, is accounted for, primarily, by the general improvement in business conditions and the almost universal prosperity that the country is now enjoying. But a large amount of this business can also be accounted for by the number of new developments which were made during the year in the application of brass and copper materials to new uses.

Probably the largest outstanding item of this sort can be found in the phenomenal development of the automatic refrigerators, both for household use and for stores, and even more especially for ice-cream dispensers. Enormous quantities of sheet copper and seamless copper tubes have been used in the manufacture of these refrigerating cabinets and the business is still continuing to grow at a phenomenal rate. The building trade and the automobile industry have contributed their share in the consumption of brass and copper, as has also the electrical industry. However, although most of the mills are well pleased with the situation from the order-book viewpoint, it cannot be said that the same degree of satisfaction prevails as to the expectation of what the figures will show as to profits in the final balance sheet for the year. Practically all of the mills claim they have made very little money and some of them have definitely stated that they have maintained their dividends by drawing on their surplus.

It may seem strange that in a year when the manufacturers in most other industries are reporting handsome profits, that such a large industry as the brass and copper business should be skimming along on thin profits. It will be recalled, however, that the change for the better in the brass and copper industry did not begin until about the middle of the year. Prior to that time the scramble for orders was intense and prices were cut in an indiscriminate manner with the one idea in mind, of filling up the order-books rather than holding prices for profits. This condition prevailed right up to the last of the summer months, with the result that the profits up to that time were so thin that, although the operations of the past three or four months have been much more to the liking of the manufacturers, there has not been a sufficient profit in that period to carry the burden of the profitless months in the earlier part of the year, and bring the sum total up to a reasonable profit on the total amount of business done over the entire year.

The situation in that part of the industry having to do with the white metal alloys of nickel and copper, as well as pure nickel and Monel metal, is much the same as the business activity which is above reported for the brass and copper business. Many new developments during the year have been responsible for the creation of a demand for the white metal on a scale which has heretofore been unknown, and which has been beyond the fondest expectation of the producers. The producers of Monel metal and pure nickel sheet enter the year with a volume of orders on their books which is larger than at any time in the history of the business. There appears to be a very definite trend toward an ever-increasing consumption of nickel and nickel-copper alloys, due to the demand arising from the many new industries to which these metals are being applied, and the manufacturers in this line view the future with the utmost optimism.

Looking back over a period of years, it is difficult to recall any period in the history of the metal industry when the outlook was brighter than it is today.

Metal Market Review

Written for The Metal Industry by R. J. HOUSTON, of D. Houston & Company, Inc., Metal Brokers, New York

GENERAL BUSINESS CONDITIONS

JANUARY 5, 1926.

Notable expanson in basic industries and general business marked the course of events during 1925. At the very beginning of the year many favorable developments were clearly discernible, and as the months passed the evident trend toward progressive betterment became more pronounced. Confidence was the dominant factor in giving stimulus to business activity. Heavy demand for all essential products attained enormous proportions, increasing purchasing power of the country was developed, and wide markets created a free outlet for record-breaking production.

There were signs of business growth in the steel industry. The railroads were eminently successful last year, and the huge building program continued at a high level. The automobile and copper consuming industries also operated under the impetus of a tremendous demand. Conditions, therefore, in the business and financial situation of the country were, in the main, gratifying. There was ample proof of the stability and growth of trade and industry. The situation when analyzed shows grounds for a hopeful and bright outlook for 1926.

COPPER

The great expansion of domestic consumption of copper in the past year, together with heavy exports of the metal, has made a most substantial inroad upon existing primary stocks. American requirements broadened out enormously in 1925, the movement gaining headway during the last half of the year. The total quantity of copper withdrawn on domestic account in 1925, as determined by the Bureau of Mines, Department of Commerce, amounted to 1,485,000,000 pounds, compared with 1,355,000,000 pounds in 1924, an increase of 130,000,000 pounds.

In 1925 the production of new refined copper from domestic and foreign sources amounted to about 2,237,000,000 pounds, compared with 2,260,000,000 pounds in 1924, a decrease of 23,000,000 pounds. The government statement also gives imports of refined copper last year amounting to 120,000,000 pounds, and a carryover in stocks on December 31, 1924, of 243,000,000 pounds. Total supplies available in 1925, therefore, were 2,600,000,000 pounds in refined form, and total deliveries for domestic and export account were 2,488,000,000 pounds, thus leaving surplus stocks of refined copper of only 112,000,000 pounds on December 31, 1925, being a decrease of 131,000,000 pounds during the year. These figures differ somewhat from privately compiled statistics, but for the purposes of this article the official method of calculation is given.

Market conditions for copper displayed considerable irregularity during the year just closed. The price level at the beginning of 1925 was 14⅞ @ 15 cents for electrolytic and later advanced to 15⅛ cents. An easier tendency soon set in, however, and buying power was not urgent enough to prevent gradually receding values. The erratic and uncertain European tone made its impression on this side in frequent revision of prices. The low price for the year was 13¼ cents delivered basis, with a possible shading of that figure for a small tonnage. A fairly firm tone prevails at the opening of the new year with quotations of 14⅛ @ 14¼ cents. Average price during the last twelve months was a little better than for 1924. It can hardly be said that the market has given a good account of itself in 1925, however, in view of the gigantic demand and the sound statistical position. Copper would be reasonably cheap at 16 cents. Certainly this is little enough when one considers the investments in the industry and the increased cost of equipment and wages. There is a world-wide apprehension that production can be promptly increased to exceed demand, and, right or wrong, this impression prevails both in this country and Europe. And this fact is the bugbear and handicap of the copper situation.

ZINC

Renewed prosperity was the powerful stimulant to steady and consistent demand for slab zinc and zinc products during last year. The position of this metal, like that of lead, was kept exceptionally sound by the conservative action of producers in avoiding a heavy over-supply. Consuming conditions were decidedly favorable to a large distribution. Deliveries have exceeded output, and that fact accounts for the recent firmness of the market and the premium offered for prompt shipments.

Stocks of zinc have been showing important decreases month after month since June. Europe has been filling some requirements from this side. Domestic demand, however, was the pronounced feature. So far as the general outlook is concerned the prospects for large consumption is still encouraging. During 1925 fluctuations in this market moved between a high of 8.90 and a low of 6.75 cents for prime Western East St. Louis basis. The current market quotations are 8.75 cents at East St. Louis and 9.10 cents at New York for prompt shipment.

TIN

American consumption of tin in 1925, as indicated by deliveries, readily account for the extraordinary strength of prices. Total United States deliveries last year amounted to 76,455 gross tons, compared with 64,125 tons in 1924, an increase of 12,330 tons. The inherent strength of the market was apparent throughout the greater part of the year, but was especially pronounced during the last quarter of 1925. Fluctuations over the twelve month period showed a spread of 14½ cents a pound, the movement being between the low of 50 cents and the high of 64½ cents for spot Straits.

Total visible supplies show that world available tonnage was down to 18,024 tons on December 31, 1925, being a reduction of 7,064 tons in 12 months. The big demand for tin is in this country. There was some increase in consumption in England and on the Continent last year, but the domestic demand continues to be the backbone of the tin market. Prices at the opening of 1926 were quoted at 63½ cents for prompt Straits. Continued national prosperity this year is likely to mean consumption of record proportions in 1926.

LEAD

A healthy equilibrium was maintained between production and consumption in 1925. This sound economic principle has proved a successful policy for the producer at any rate. It has also contributed to a stable market which did not surprise the consumer by sudden slumps to disturb his contract placements for manufactured products. There may not be reason to fear a "saturation point" in lead output, as in copper, but in the case of lead, the balanced situation is of obvious benefit in many ways.

The persistent strength of the market for over two years has been an outstanding feature. Consumers have displayed confidence by regular and large purchases. Producers have, therefore, been able to keep up their shipments without being compelled to carry annoying accumulation of stocks. Price fluctuations were between a high of 10.75 cents and a low of 7.30 cents East St. Louis basis. The present market quotes 9.25 @ 9.50 cents at New York, with a fair inquiry.

ALUMINUM

The market for virgin aluminum in 1925 was practically undisturbed by the uncertainties and price fluctuations incident to the markets for other metals. It would seem that producers were singularly sure of their position and of the soundness of underlying conditions which could possibly affect the industry. Domestic consumption was in heavy volume. Important developments are expected to create a wider use of the metal in 1926. There has been a rare combination of favorable circumstances which promises to give new and larger outlets for both domestic and imported aluminum. The stability of the market last year was attested by the ability of sellers to hold it at 27 @ 28 cents for virgin 98-99% grade. At the beginning of this year the leading domestic producer announced a reduction of one cent per pound in its prices for ingot aluminum, to 28.00 cents for 99% and 27.00 cents for 98-99%. The new prices were effective January 1st.

ANTIMONY

Restricted supplies and unsettled conditions in China have operated to raise prices to an abnormal level. With output so curtailed and the product under strong Chinese control the market has been erratic and uncertain for many months. Consumers, however, are less timid than they were and have bought on a fair scale recently. Market prices at present are up to 25 cents duty paid for spot parcels of Chinese Regulars. Current prices are more than double what they were several months ago, and the scarcity of unsold shipments foreshadows even a higher range of values. The situation has become more acute lately, and holders in the Orient, and dealers fortunate enough to have secured contracts at lower prices, are inclined to make the most of the present stringency. A small supply of Mexican material is being shipped to Europe, but the quantity is inadequate to make a very definite impression on the situation. Domestic prices in 1925 covered a range of 24.50 cents high and 11.00 cents low.

QUICKSILVER

Increased demand caused a substantial advance in prices of quicksilver during the past year. An appreciable decrease in recent output in Spain was reported. Imports were heavy, but they were readily absorbed by the trade. Supplies are reported light, and the market is steady at $89 per flask. Fluctuations in 1925 were between $78 and $91 per flask.

SILVER

Silver price trend in 1925 showed a better average than in 1924. The high being 72⅞ cents and the low 66½ cents compared with a high of 72.2 cents and a low of 62.8 cents in 1924. Far Eastern and European consumption may become larger this year. India and China are heavy consumers. Market operations were relatively quiet recently. The Orient has been in and out of the market from time to time. Domestic requirements were in good volume, with substantial quantities taken for government account sometime ago. Statistics for the year 1925 are not yet available, but they will show interesting movements during the year when the completed data are ready. Present price quotes 68½ per ounce.

PLATINUM

A fair movement in platinum was maintained during the year just closed. The demand, however, was not specially active recently and prices reflect lack of sufficient market animation to stimulate an upward movement. The refined metal quotes $114.50 @ $116 per ounce.

OLD METALS

There was a large movement in old metals in 1925. Prices were adjusted frequently in conformity to the changes in prices for new materials. Consumption was heavy and liberal quantities were taken by the trade. Supply and demand operated in the old supplies as it does in all commodities. Demand for old metals is continually extending in the various lines of industry. The trade outlook, therefore, is encouraging for an active year ahead. Stocks are apparently rather small in consumers' hands, and a new buying movement of good dimensions is expected in the coming weeks. Prices dealers quote for buying are 11½ @ 11¾ cents for heavy copper, 7 @ 7¼ cents for heavy brass, 7.75 @ 8.00 cents for heavy lead, 9¼ @ 9½ cents for new brass clippings, and 23 @ 23½ cents for aluminum clippings.

WATERBURY AVERAGE

Lake Copper—Average for 1924, 13.419—January, 1925, 15.125—February, 15.00—March, 14.375—April, 13.625—May, 13.625—June, 13.75—July, 14.25—August, 14.875—September, 14.875—October, 14.625—November, 14.75—December, 14.25.

Brass Mill Zinc—Average for 1924, 7.10—January, 1925, 8.60—February, 8.00—March, 8.10—April, 7.60—May, 7.55—June, 7.55—July, 7.80—August, 8.10—September, 8.30—October, 8.90—November, 9.40—December, 9.25.

Daily Metal Prices for the Month of December, 1925

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	4	7	8	9	10	11	14	15	16	17
Copper (f. o. b. Ref.) c/lb. Duty Free													
Lake (Delivered)	14.375	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25
Electrolytic	14.15	14.00	13.90	14.00	14.00	14.00	13.95	13.95	13.95	13.85	13.85	13.85	14.00
Casting	13.60	13.50	13.40	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	8.70	8.50	8.60	8.75	8.80	8.80	8.75	8.75	8.75	8.75	8.75	8.70	8.70
Brass Special	8.85	8.70	8.75	8.85	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.90	8.95
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	63.75	63.25	62.75	63.75	63.50	63.50	63.50	63.125	63.00	62.125	61.25	61.625	62.25
Pig 99%	62.75	62.375	62.00	63.00	62.75	62.75	62.75	62.375	62.00	61.25	60.50	60.875	61.50
Lead (f. o. b. St. L.) c/lb. Duty 2⅜c/lb.	9.35	9.35	9.35	9.35	9.35	9.15	9.15	9.15	9.15	9.10	9.10	9.10	9.10
Aluminum c/lb. Duty 5c/lb.	29	29	29	29	29	29	29	29	29	29	29	29	29
Nickel c/lb. Duty 3c/lb.													
Ingot	34	34	34	34	34	34	34	34	34	34	34	34	34
Shot	35	35	35	35	35	35	35	35	35	35	35	35	35
Electrolytic	38	38	38	38	38	38	38	38	38	38	38	38	38
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	20.00	20.25	20.25	20.25	20.25	20.50	20.75	21.00	21.25	22.00	22.00	22.00	22.00
Silver c/oz. Troy Duty Free	69.25	69.125	69.25	69.375	69.25	69.25	69.25	69.125	69.125	69	68.375	68.25	68.625
Platinum $/oz. Troy Duty Free	118	118	118	118	118	118	118	118	118	118	118	118	118

	18	21	22	23	24	*25	28	29	30	31	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free													
Lake (Delivered)	14.25	14.25	14.25	14.25	14.25	.....	14.25	14.25	14.25	14.25	14.375	14.25	14.256
Electrolytic	14.05	14.00	13.95	13.95	13.95	.....	13.95	13.95	13.95	13.95	14.15	13.85	13.961
Casting	13.55	13.55	13.50	13.375	13.375	.....	13.375	13.375	13.375	13.375	13.60	13.375	13.470
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	8.70	8.75	8.75	8.75	8.70	.....	8.70	8.70	8.70	8.70	8.80	8.50	8.716
Brass Special	8.95	8.90	8.90	8.90	8.90	.....	8.90	8.90	8.90	8.90	8.95	8.70	8.90
Tin (f. o. b. N. Y.) c/lb Duty Free													
Straits	62.50	62.75	62.50	63.00	63.00	.....	63.25	63.00	63.375	63.625	63.75	61.25	62.926
Pig 99%	61.50	62.00	61.625	62.00	62.00	.....	62.375	62.125	62.50	62.75	63.00	60.50	62.080
Lead (f. o. b. St. L.) c/lb. Duty 2⅜c/lb.	9.10	9.10	9.15	9.20	9.20	.....	9.20	9.20	9.20	9.20	9.35	9.10	9.195
Aluminum c/lb. Duty 5c/lb.	29	29	29	29	29	.....	29	29	29	29	29	29	29
Nickel c/lb. Duty 3c/lb.													
Ingot	34	34	34	34	34	.....	34	34	34	34	34	34	34
Shot	35	35	35	35	35	.....	35	35	35	35	35	35	35
Electrolytic	38	38	38	38	38	.....	38	38	38	38	38	38	38
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	22.00	22.00	22.00	22.25	22.25	.....	22.50	23.50	24.00	24.50	24.50	20.00	21.705
Silver c/oz. Troy Duty Free	69	69	69	68.875	68.50	.....	68.50	68.375	68.375	68.50	69.375	68.25	68.881
Platinum $/oz. Troy Duty Free	116	116	116	116	116	.....	116	116	116	116	118	116	117.182

*Holiday.

Metal Prices, January 11, 1926

New Metals

Copper: Lake, 14.25. Electrolytic, 14.00. Casting, 13.40.
Zinc: Prime Western, 8.70. Brass Special, 8.85,
Tin: Straits, 62.25. Pig, 99%, 61.25.
Lead: 9.20. **Aluminum**, 28.00. **Antimony**, 24.25.
Nickel: Ingot, 35.00. Shot, 36.00. Electrolytic, 39.00. Pellets cobalt free, 40.00.

Quicksilver, flask, 75 lbs., $88.00. **Silver**, oz., Troy, 68.375.

Bismuth	$3.30to$3.35
Cadmium	60
Cobalt, 97% pure	$2.50to$2.60
Platinum, oz., Troy	$116.00
Gold, oz., Troy	$20.67

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10¾to11¾
Brass Ingots, Red	11¾to12¾
Bronze Ingots	11¾to12¾
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to41
Manganese Bronze Ingots	13 to17
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	28 to45
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18⅞to22½
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	70 to80
Phosphor Tin, no guarantee	65 to75
Silicon Copper, 10% ......according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
12¼to12½	Heavy Cut Copper	13¼to13¾
12 to12¼	Copper Wire	13 to13½
10¼to10¾	Light Copper	11½to12
9¼to 9½	Heavy Machine Comp	10¾to11¼
8 to 8¼	Heavy Brass	9¼to 9½
7 to 7¼	Light Brass	8 to 8½
8 to 8½	No. 1 Yellow Brass Turnings	10 to10½
8¾to 9	No. 1 Comp. Turnings	10½to11
8½to 8¾	Heavy Lead	9¼to 9½
5 to 5¼	Zinc Scrap	6 to 6½
12 to13	Scrap Aluminum Turnings	15 to17
19 to20	Scrap Aluminum, cast alloyed	21 to22
23 to24	Scrap Aluminum, sheet (new)	25 to26½
38 to40	No. 1 Pewter	42 to44
12	Old Nickel anodes	14
18	Old Nickel	20

Wrought Metals

BRASS MATERIAL—MILL SHIPMENTS

In effect Jan. 5, 1926
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19⅛	$0.20⅝	$0.22⅝
Wire	.19⅝	.21⅛	.23⅛
Rod	.16⅞	.21⅜	.23⅜
Brazed tubing	.27⅛	......	.32⅜
Open seam tubing	.27⅛	......	.32⅜
Angles and channels	.30⅛	......	.35⅜

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.20⅛	$0.21⅝	$0.23⅝
Wire	.20⅝	.22⅛	.24⅛
Rod	.17⅞	.22⅜	.24⅜
Brazed tubing	.28⅛	......	.33⅜
Open sea tubing	.28⅛	......	.33⅜
Angles and channels	.31⅛	......	.36⅜

BRASS AND COPPER SEAMLESS TUBING

Brass, 23¾c. to 24¾c. net base.
Copper, 24½c. to 25½c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21⅛c. net base
Muntz or Yellow Metal Sheathing (14"x48")	19⅛c. net base
Muntz or Yellow Rectangular sheet other Sheathing	20⅛c. net base
Muntz or Yellow Metal Rod	17⅛c. net base

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21½c. to 22½c. net base
From stock	22½c. to 23½c. net base

BARE COPPER WIRE—CARLOAD LOTS

16⅜c. to 16¾c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	21c. net base
100 lbs. to 200 lbs. in one order	21½c. net base

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	27c.
15% "	28½c.
18% "	29¾c.

Nickel Silver Wire and Rod

10% "	30c.
15% "	33¾c.
18% "	37c.

ZINC SHEET

Duty, sheet, 15% Cents per lb.

Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	12.00 net base
Casks, jobbers' price	13.25 net base
Open Casks, jobbers' price	13.75 to 14.00 net base

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	35
Cold Drawn Rods (base)	43
Hot Rolled Sheets (base)	42
Cold Rolled Sheets (base)	50

ANTIMONY

Restricted supplies and unsettled conditions in China have operated to raise prices to an abnormal level. With output so curtailed and the product under strong Chinese control the market has been erratic and uncertain for many months. Consumers, however, are less timid than they were and have bought on a fair scale recently. Market prices at present are up to 25 cents duty paid for spot parcels of Chinese Regulars. Current prices are more than double what they were several months ago, and the scarcity of unsold shipments foreshadows even a higher range of values. The situation has become more acute lately, and holders in the Orient, and dealers fortunate enough to have secured contracts at lower prices, are inclined to make the most of the present stringency. A small supply of Mexican material is being shipped to Europe, but the quantity is inadequate to make a very definite impression on the situation. Domestic prices in 1925 covered a range of 24.50 cents high and 11.00 cents low.

QUICKSILVER

Increased demand caused a substantial advance in prices of quicksilver during the past year. An appreciable decrease in recent output in Spain was reported. Imports were heavy, but they were readily absorbed by the trade. Supplies are reported light, and the market is steady at $89 per flask. Fluctuations in 1925 were between $78 and $91 per flask.

SILVER

Silver price trend in 1925 showed a better average than in 1924. The high being 72⅞ cents and the low 66½ cents compared with a high of 72.2 cents and a low of 62.8 cents in 1924. Far Eastern and European consumption may become larger this year. India and China are heavy consumers. Market operations were relatively quiet recently. The Orient has been in and out of the market from time to time. Domestic requirements were in good volume, with substantial quantities taken for government account sometime ago. Statistics for the year 1925 are not yet available, but they will show interesting movements during the year when the completed data are ready. Present price quotes 68½ per ounce.

PLATINUM

A fair movement in platinum was maintained during the year just closed. The demand, however, was not specially active recently and prices reflect lack of sufficient market animation to stimulate an upward movement. The refined metal quotes $114.50 @ $116 per ounce.

OLD METALS

There was a large movement in old metals in 1925. Prices were adjusted frequently in conformity to the changes in prices for new materials. Consumption was heavy and liberal quantities were taken by the trade. Supply and demand operated in the old supplies as it does in all commodities. Demand for old metals is continually extending in the various lines of industry. The trade outlook, therefore, is encouraging for an active year ahead. Stocks are apparently rather small in consumers' hands, and a new buying movement of good dimensions is expected in the coming weeks. Prices dealers quote for buying are 11½ @ 11¾ cents for heavy copper, 7 @ 7¼ cents for heavy brass, 7.75 @ 8.00 cents for heavy lead, 9¼ @ 9½ cents for new brass clippings, and 23 @ 23½ cents for aluminum clippings.

WATERBURY AVERAGE

Lake Copper—Average for 1924, 13.419—January, 1925, 15.125—February, 15.00—March, 14.375—April, 13.625—May, 13.625—June, 13.75—July, 14.25—August, 14.875—September, 14.875—October, 14.625—November, 14.75—December, 14.25.

Brass Mill Zinc—Average for 1924, 7.10—January, 1925, 8.60—February, 8.00—March, 8.10—April, 7.60—May, 7.55—June, 7.55—July, 7.80—August, 8.10—September, 8.30—October, 8.90—November, 9.40—December, 9.25.

Daily Metal Prices for the Month of December, 1925

Record of Daily, Highest, Lowest and Average Prices and the Customs Duties

	1	2	3	4	7	8	9	10	11	14	15	16	17
Copper (f. o. b. Ref.) c/lb. Duty Free													
Lake (Delivered)	14.375	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25	14.25
Electrolytic	14.15	14.00	13.90	14.00	14.00	14.00	13.95	13.95	13.95	13.85	13.85	13.85	14.00
Casting	13.60	13.50	13.40	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50	13.50
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	8.70	8.50	8.60	8.75	8.80	8.80	8.75	8.75	8.75	8.75	8.75	8.70	8.70
Brass Special	8.85	8.70	8.75	8.85	8.95	8.95	8.95	8.95	8.95	8.95	8.95	8.90	8.95
Tin (f. o. b. N. Y.) c/lb. Duty Free													
Straits	63.75	63.25	62.75	63.75	63.50	63.50	63.50	63.125	63.00	62.125	61.25	61.625	62.25
Pig 99%	62.75	62.375	62.00	63.00	62.75	62.75	62.75	62.375	62.00	61.25	60.50	60.875	61.50
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	9.35	9.35	9.35	9.35	9.35	9.15	9.15	9.15	9.15	9.10	9.10	9.10	9.10
Aluminum c/lb. Duty 5c/lb.	29	29	29	29	29	29	29	29	29	29	29	29	29
Nickel c/lb. Duty 3c/lb.													
Ingot	34	34	34	34	34	34	34	34	34	34	34	34	34
Shot	35	35	35	35	35	35	35	35	35	35	35	35	35
Electrolytic	38	38	38	38	38	38	38	38	38	38	38	38	38
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	20.00	20.25	20.25	20.25	20.25	20.50	20.75	21.00	21.25	22.00	22.00	22.00	22.00
Silver c/oz. Troy Duty Free	69.25	69.125	69.25	69.375	69.25	69.25	69.25	69.125	69.125	69	68.375	68.25	68.625
Platinum $/oz. Troy Duty Free	118	118	118	118	118	118	118	118	118	118	118	118	118

	18	21	22	23	24	*25	28	29	30	31	High	Low	Aver.
Copper (f. o. b. Ref.) c/lb. Duty Free													
Lake (Delivered)	14.25	14.25	14.25	14.25	14.25	.....	14.25	14.25	14.25	14.25	14.375	14.25	14.256
Electrolytic	14.05	14.00	13.95	13.95	13.95	.....	13.95	13.95	13.95	13.95	14.15	13.85	13.961
Casting	13.55	13.55	13.50	13.375	13.375	.....	13.375	13.375	13.375	13.375	13.60	13.375	13.470
Zinc (f. o. b. St. L.) c/lb. Duty 1¾c/lb.													
Prime Western	8.70	8.75	8.75	8.75	8.70	.....	8.70	8.70	8.70	8.70	8.80	8.50	8.716
Brass Special	8.95	8.90	8.90	8.90	8.90	.....	8.90	8.90	8.90	8.90	8.95	8.70	8.90
Tin (f. o. b. N. Y.) c/lb Duty Free													
Straits	62.50	62.75	62.50	63.00	63.00	.....	63.25	63.00	63.375	63.625	63.75	61.25	62.926
Pig 99%	61.50	62.00	61.625	62.00	62.00	.....	62.375	62.125	62.50	62.75	63.00	60.50	62.080
Lead (f. o. b. St. L.) c/lb. Duty 2⅛c/lb.	9.10	9.10	9.15	9.20	9.20	.....	9.20	9.20	9.20	9.20	9.35	9.10	9.195
Aluminum c/lb. Duty 5c/lb.	29	29	29	29	29	.....	29	29	29	29	29	29	29
Nickel c/lb. Duty 3c/lb.													
Ingot	34	34	34	34	34	.....	34	34	34	34	34	34	34
Shot	35	35	35	35	35	.....	35	35	35	35	35	35	35
Electrolytic	38	38	38	38	38	.....	38	38	38	38	38	38	38
Antimony (J. & Ch.) c/lb. Duty 2c/lb.	22.00	22.00	22.00	22.25	22.25	.....	22.50	23.50	24.00	24.50	24.50	20.00	21.705
Silver c/oz. Troy Duty Free	69	69	69	68.875	68.50	.....	68.50	68.375	68.375	68.50	69.375	68.25	68.881
Platinum $/oz. Troy Duty Free	116	116	116	116	116	.....	116	116	116	116	118	116	117.182

*Holiday.

Metal Prices, January 11, 1926

New Metals

Copper: Lake, 14.25. Electrolytic, 14.00. Casting, 13.40.
Zinc: Prime Western, 8.70. Brass Special, 8.85,
Tin: Straits, 62.25. Pig, 99%, 61.25.
Lead: 9.20. **Aluminum,** 28.00. **Antimony,** 24.25.
Nickel: Ingot, 35.00. Shot, 36.00. Electrolytic, 39.00. Pellets cobalt free, 40.00.

Quicksilver, flask, 75 lbs., $88.00. **Silver,** oz., Troy, 68.375.	
Bismuth	$3.30to$3.35
Cadmium	60
Cobalt, 97% pure	$2.50to$2.60
Platinum, oz., Troy	$116.00
Gold, oz., Troy	$20.67

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	10¾to11¾
Brass Ingots, Red	11¾to12¾
Bronze Ingots	11¾to12¾
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	23 to41
Manganese Bronze Ingots	13 to17
Manganese Bronze Forging	34 to42
Manganese Copper, 30%	28 to45
Parsons Manganese Bronze Ingots	18¼to19¾
Phosphor Bronze	24 to30
Phosphor Copper, guaranteed 15%	18⅞to22½
Phosphor Copper, guaranteed 10%	18 to21½
Phosphor Tin, guaranteed 5%	70 to80
Phosphor Tin, no guarantee	65 to75
Silicon Copper, 10% ......according to quantity	28 to35

OLD METALS

Buying Prices		Selling Prices
12¼to12½	Heavy Cut Copper	13¼to13¾
12 to12¼	Copper Wire	13 to13½
10¼to10¾	Light Copper	11½to12
9¼to 9½	Heavy Machine Comp	10¾to11¼
8 to 8¼	Heavy Brass	9¼to 9½
7 to 7¼	Light Brass	8 to 8½
8 to 8½	No. 1 Yellow Brass Turnings	10 to10½
8¾to 9	No. 1 Comp. Turnings	10½to11
8½to 8¾	Heavy Lead	9¼to 9½
5 to 5¼	Zinc Scrap	6 to 6½
12 to13	Scrap Aluminum Turnings	15 to17
19 to20	Scrap Aluminum, cast alloyed	21 to22
23 to24	Scrap Aluminum, sheet (new)	25 to26½
38 to40	No. 1 Pewter	42 to44
12	Old Nickel anodes	14
18	Old Nickel	20

Wrought Metals

BRASS MATERIAL—MILL SHIPMENTS

In effect Jan. 5, 1926
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.19⅛	$0.20⅝	$0.22⅝
Wire	.19⅝	.21⅛	.23⅛
Rod	.16⅞	.21⅜	.23⅜
Brazed tubing	.27⅛	......	.32⅜
Open seam tubing	.27⅛	......	.32⅜
Angles and channels	.30⅛	......	.35⅜

To customers who buy less than 5,000 lbs. in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.20⅛	$0.21⅝	$0.23⅝
Wire	.20⅝	.22⅛	.24⅛
Rod	.17⅞	.22⅜	.24⅜
Brazed tubing	.28⅛	......	.33⅜
Open sea tubing	.28⅛	......	.33⅜
Angles and channels	.31⅛	......	.36⅜

BRASS AND COPPER SEAMLESS TUBING

Brass, 23¾c. to 24¾c. net base.
Copper, 24½c. to 25½c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	21⅛c. net base
Muntz or Yellow Metal Sheathing (14"x48")	19⅛c. net base
Muntz or Yellow Rectangular sheet other Sheathing	20⅛c. net base
Muntz or Yellow Metal Rod	17⅛c. net base

Above are for 100 lbs. or more in one order.

COPPER SHEET

Mill shipments (hot rolled)	21½c. to 22½c. net base
From stock	22½c. to 23½c. net base

BARE COPPER WIRE—CARLOAD LOTS

16⅜c. to 16¾c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	21c. net base
100 lbs. to 200 lbs. in one order	21½c. net base

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Nickel Silver Sheet Metal

10% Quality	27c.
15% "	28½c.
18% "	29¾c.

Nickel Silver Wire and Rod

10% "	30c.
15% "	33¾c.
18% "	37c.

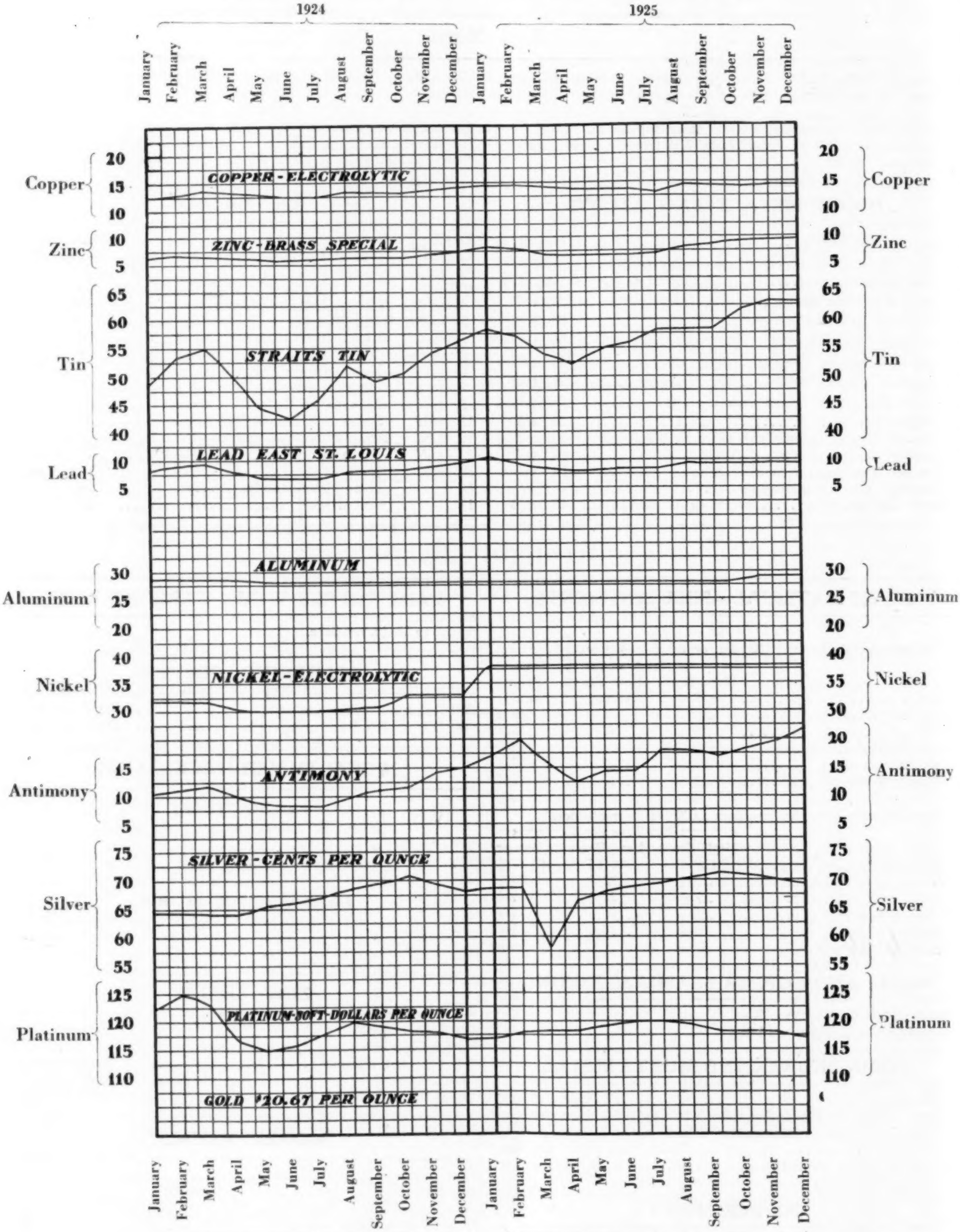
ZINC SHEET

Duty, sheet, 15%	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 8 per cent discount	12.00 net base
Casks, jobbers' price	13.25 net base
Open Casks, jobbers' price	13.75 to 14.00 net base

MONEL METAL

Shot	32
Blocks	32
Hot Rolled Rods (base)	35
Cold Drawn Rods (base)	43
Hot Rolled Sheets (base)	42
Cold Rolled Sheets (base)	50

Chart of Metal Prices for 1924-1925



Pig Iron and Metal Products of the United States

Calendar Years 1916-1924. (1925 Estimated.)

(FROM THE UNITED STATES BUREAU OF MINES.)

PRODUCTS METALLIC	1916 Quantity	1916 Value	1917 Quantity	1917 Value	1918 Quantity	1918 Value	Products
Pig iron (spot value), long tons...	39,126,324	$663,478,118	38,612,546	$1,053,785,975	38,230,440	$1,180,759,565	Pig iron
Copper, value at New York, pounds..	1,927,850,548	474,288,000	1,886,120,721	514,911,000	1,908,533,595	471,408,000	Copper
Zinc, value at St. Louis, short tons (g)	564,338	151,243,000	584,597	119,258,000	492,405	89,618,000	Zinc
Tin, short tons	140	122,000	110	135,600	69	118,500	Tin
Lead (ref.) New York, short tons (h)	552,228	76,207,000	548,450	94,333,000	539,905	76,667,000	Lead
Aluminum, pounds	*	33,900,000	*	45,882,000	*	41,159,000	Aluminum
Nickel, value at New York, short tons	918	671,192	402	331,556	441	401,000	Nickel
Quicksilver, value at S. Fran., flasks.	29,932	3,768,139	36,159	3,808,266	32,883	3,863,752	Quicksilver
Antimonial lead, short tons (F. & D.)	24,038	4,483,582	18,646	3,781,560	18,570	2,826,350	Antim. Lead
Silver, commercial value, troy ounces.	74,414,802	48,953,000	71,740,362	59,078,100	67,810,139	66,485,129	Silver
Gold, coining value, troy ounces.....	4,479,056	92,590,300	4,051,440	83,750,700	3,320,784	68,646,700	Gold
Platinum, New York City, troy oz...	28,088	2,301,762	38,831	4,023,757	59,753	6,417,980	Platinum
Total value of metallic products (approximate) (b)	....	$1,620,745,000	....	$2,086,234,000	....	$2,153,318,000	

PRODUCTS METALLIC	1919 Quantity	1919 Value	1920 Quantity	1920 Value	1921 Quantity	1921 Value	Products
Pig iron (spot value), long tons....	30,130,231	$775,915,043	35,710,227	$1,140,904,096	16,038,619	$389,437,792	Pig iron
Copper, sales value, pounds........	1,286,419,329	239,274,000	1,209,061,040	222,467,000	505,586,098	65,221,000	Copper
Zinc, sales value, short tons (g).....	452,272	66,032,000	450,045	72,907,000	198,232	19,823,000	Zinc
Tin, short tons	56	73,400	22	22,000	4	2,400	Tin
Lead (ref.) New York, short tons (h)	424,433	44,990,000	476,849	76,296,000	398,222	35,840,000	Lead
Aluminum, pounds	*	38,558,000	*	41,375,000	*	10,906,000	Aluminum
Nickel, value at New York, short tons	511	434,485	365	293,250	111	86,000	Nickel
Quicksilver, value at S. Fran., flasks.	21,415	1,933,560	13,392	1,066,807	6,339	300,595	Quicksilver
Antimonial lead, short tons (F. & D.)	13,874	1,513,968	12,535	1,963,255	10,064	870,059	Antim. Lead
Silver, commercial value, troy ounces.	56,682,445	63,533,652	55,361,573	60,801,955	53,052,441	53,052,441	Silver
Gold, coining value, troy ounces	2,918,628	60,333,400	2,476,166	51,186,900	2,422,006	50,067,300	Gold
Platinum and allied metals, value at New York City, troy ounces......	45,109	5,614,335	41,544	4,697,722	56,370	4,238,989	Platinum
Total value of metallic products (approximate) (b)	....	$1,359,744,000	....	$1,762,350,000	....	$654,130,000	

PRODUCTS METALLIC	1922 Quantity	1922 Value	1923 Quantity	1923 Value	1924 Quantity	1924 Value	Products
Pig iron (spot value), long tons....	27,670,738	$608,144,858	38,361,379	$946,799,378	31,064,129	$665,078,972	Pig iron
Copper, sales value, pounds........	950,285,947	128,289,000	1,434,999,962	210,945,000	1,634,249,192	214,087,000	Copper
Zinc, sales value, short tons (g).....	353,274	40,273,000	508,335	69,134,000	515,831	67,058,000	Zinc
Tin, short tons	1	912	2	1,623	7	7,000	Tin
Lead (ref.) sales value, short tons (h)	468,746	51,562,000	543,841	76,138,000	566,407	90,625,000	Lead
Aluminum, pounds	*	13,622,000	*	28,305,000	....	37,607,000	Aluminum
Nickel, value at New York, short tons	208	133,191	100	71,605	191	114,903	Nickel
Quicksilver, value at S. Fran., flasks.	6,375	368,348	7,937	521,302	10,061	691,090	Quicksilver
Antimonial lead, short tons (F. & D.)	8,075	844,993	14,190	1,950,370	20,787	3,376,713	Antim. Lead
Silver, commercial value, troy ounces.	56,240,048	56,240,048	73,335,170	60,134,839	65,407,186	43,822,814	Silver
Gold, coining value, troy ounces	2,363,075	48,849,100	2,502,632	51,734,000	2,528,900	52,277,000	Gold
Platinum and allied metals, value at New York City, troy ounces......	57,718	5,732,726	49,797	5,762,305	66,007	7,611,319	Platinum
Total value of metallic products (approximate) (b)	....	$987,180,000	....	$1,498,200,000		(Not Available)	

1925 ESTIMATED†	Quantity	Value Total	Value Per Unit
Pig iron (spot value) long tons	36,000,000	$740,880,000	$20.58 ton (a)
Copper, sales value, pounds	1,746,000,000	245,138,400	14.04c. lb. (c)
Zinc, sales value, short tons	585,000	89,154,000	7.62c. lb. (d)
Tin (imports) short tons	83,900	97,324,000	58c. lb.
Lead (refined) sales value, short tons	650,000	117,000,000	9c. lb. (c)
Aluminum	Not Obtainable		
Nickel, value at New York, short tons (Canadian)	14,494	9,421,100	32.5c. lb.
Quicksilver, value at New York, flasks	9,400	780,200	$83 flask
Antimonial lead (short tons)	18,000	3,060,000	8.5c. lb.
Silver, commercial value, troy ounces	65,700,000	45,375,705	69.065c oz. (c)
Gold, coining value, troy ounces	2,376,000	49,111,920	$20.67 oz.
Platinum (crude), ounces	300	35,700	$119 oz.

(†) Figures from Engineering and Mining Journal-Press.
(b) Includes some items of minor interest to metal trades not shown in table.
(*) Bureau not at liberty to publish figures.
(a) Composite (c) New York (d) St. Louis.
(g) Beginning with 1915, value based on average sales price.
(h) Beginning with 1917, value based on average sales price.

Metal Prices, January 11, 1926—Continued

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base price	40c.
Aluminum coils, 24 ga., base price	36.70c.
Foreign	40c.

SILVER SHEET

Rolled sterling silver 68¾ to 70¾c.

BLOCK TIN SHEET AND BRITANNIA METAL

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more, 10c. over Pig Tin. 50 to 100 lbs., 15c. over 25 to 50 lbs., 17c. over, less than 25 lbs., 25c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin price; 100 lbs. to 500 lbs., 10c. over Pig Tin, 50 to 100 lbs., 15c. over 25 to 50 lbs., 20c. over, less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, January 11, 1926

SILVER ANODES

Rolled silver anodes .999 fine are quoted at from 71½c. to 73½c. per Troy ounce, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Dia. Inches	Thickness Inches Inclusive	Less than 100 Lbs. Price Per Lb.	100 to 200 Lbs. Price Per Lb.	Over 200 Lbs. Price Per Lb.
10-12-14 & 16	1 to 3	$3.00	$2.75	$2.65
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices.

NICKEL ANODES

90 to 92% purity	45c. per lb.
90 to 92% purity	47c. per lb.
99% plus	49c. per lb.

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12" 20 ply 64/68 Unbleached	35.95
14" 20 ply 64/68 Unbleached	44.65
12" 20 ply 80/92 Unbleached	37.10
14" 20 ply 80/92 Unbleached	50.40
12" 20 ply 84/92 Unbleached	42.50
14" 20 ply 84/92 Unbleached	57.70
12" 20 ply 80/84 Unbleached	40.70
14" 20 ply 80/84 Unbleached	55.25

Sewed Pieced Buffs, per lb., bleached .70c.

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.12-.16
Acid—Boric (Boracic) Crystals	lb.	.12
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrofluoric, 30%, bbls	lb.	.08
Nitric, 36 deg., Carboys	lb.	.06
Sulphuric, 66 deg., Carboys	lb.	.02
Alcohol—Butyl	lb.	.20½-.24
Denatured in bbls	gal.	.60-.62
Alum—Lump Barrels	lb.	.03¾
Powdered, Barrels	lb.	.042
Aluminum sulphate, commercial tech	lb.	.02⅜
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech, bbls	lb.	.03¾
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.08
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.05½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls	lb.	.32
Copper— Acetate (Verdegris)	lb.	.37
Carbonate, bbls	lb.	.17
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls	lb.	.05
Cream of Tartar Crystals (Potassium bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$75.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron, Sulphate (Copperas), bbl	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.15
Nickel—Carbonate dry, bbls	lb.	.29
Chloride, bbls.	lb.	.19
Salts, single 300 lb. bbls	lb.	.10½
Salts, double 425 lb. bbls	lb.	.10
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity		.35-.40
Potash, Caustic Electrolytic 88-92% fused, drums	lb.	.093
Potassium Bichromate, casks (crystals)	lb.	.08½
Carbonate, 88-92%, casks	lb.	.06¼
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls	lb.	.02½
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.08
Silver Chloride, dry	oz.	.86
Cyanide (Fluctuating Price)	oz.	.66
Nitrate, 100 ounce lots	oz.	.48
Soda Ash, 58%, bbls	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs	lb.	.20
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls	lb.	.04¾
Phosphate, tech., bbls	lb.	.03¾
Silicate (Water Glass), bbls	lb.	.02
Sulpho Cyanide	lb.	.45
Soot, Calcined	lb.	—
Sulphur (Brimstone), bbls	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.43½
Tripoli, Powdered	lb.	.03
Wax—Bees, white ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc, Carbonate, bbls	lb.	.11
Chloride, casks	lb.	.07⅜
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03⅜